IDAHO FOREST INSECT & DISEASE CONDITIONS & PROGRAM SUMMARY 1995

IDAHO Department of Lands
USDA Forest Service
Northern & Intermountain Regions

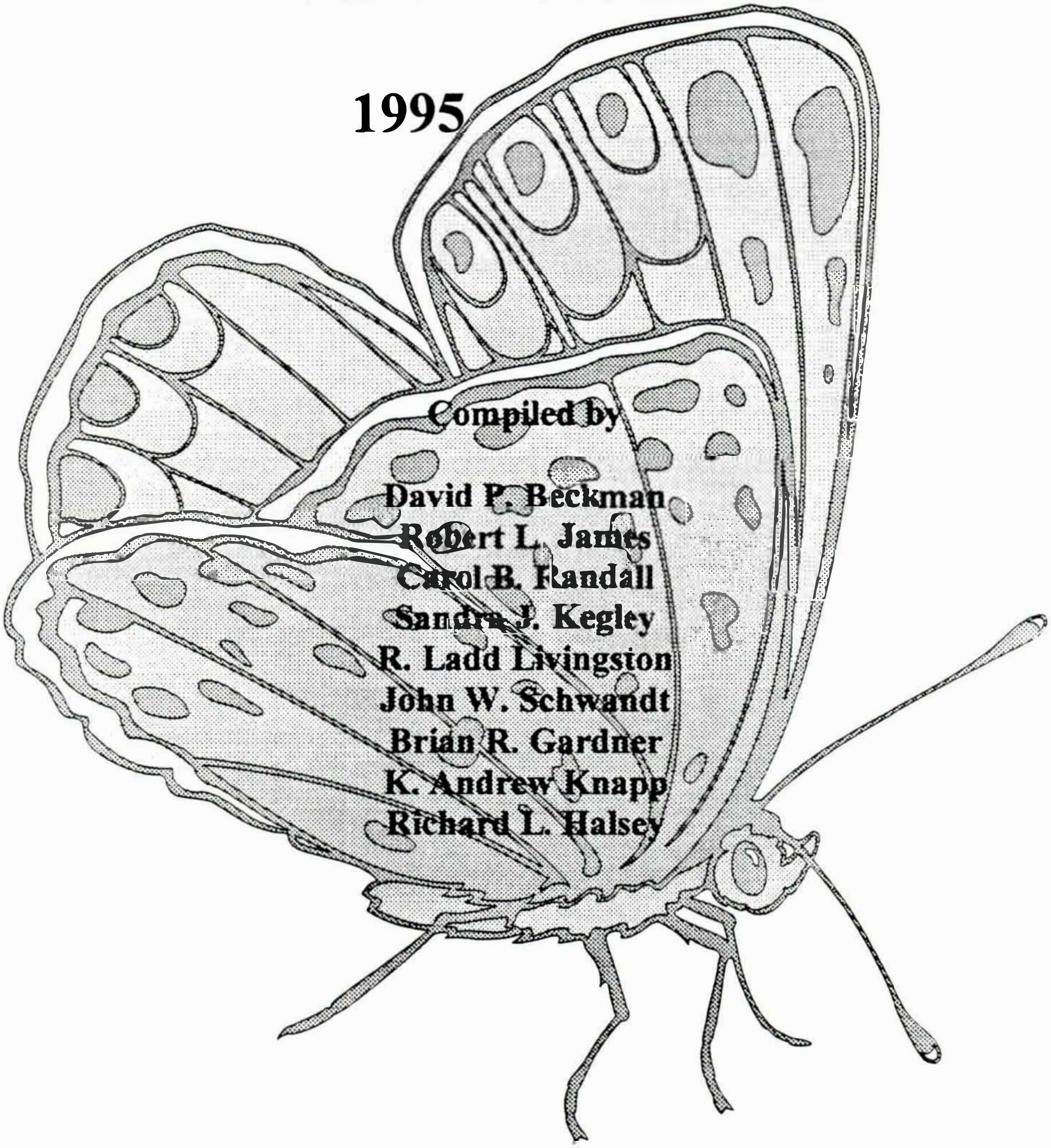
Report No. 96-1

IDAHO DEPARTMENT OF LANDS

FOREST SERVICE U S DEPARTMENT OF AGRICULTURE

IDAHO FOREST INSECT AND DISEASE CONDITIONS AND PROGRAM SUMMARY

1995



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INTRODUCTION

This report summarizes major insect and disease damage on forested lands of all ownerships within the State of Idaho for 1995. Much of the information for this report was derived from aerial and ground surveys and associated detection and evaluation activities by insect and disease specialists within the USDA Forest Service and the Idaho Department of Lands. Acres and numbers of trees reported in tables are only estimates. Likewise, maps outlining areas of major insect infestations only provide general locations of mortality.

This report also includes brief descriptions of projects insect and disease specialists are conducting in addition to the training and other technical assistance provided on a regular basis.

CONDITIONS IN BRIEF

FOREST INSECTS

The influence of the 1994 weather patterns continued to be favorable to insect development in 1995. The warm, dry spring and summer that persisted into the late fall made it especially suitable for bark beetles. In 1995 the fir engraver increased thirteen fold more than 1994, with almost all of that increase occurring in north Idaho. The bark beetle tables show all beetle activity, except for the spruce beetle and Douglas-fir beetle, increased. Mountain pine beetle attacks increased, in all host species, especially in lodgepole pine. The pine engraver also increased in lodgepole pine and along with the western pine beetle in ponderosa pine they more than doubled over that of last year with the greatest increases coming in northern Idaho. A complex of western balsam bark beetle; twig beetle; secondary bark beetles; wood borers; fir engraver and pathogens continue to damage and kill subalpine fir throughout Idaho, with the largest mortality occurring in southern Idaho. Mortality is located throughout the host type and appears to affect trees of all size classes. Decreases in tree mortality in Idaho from the spruce beetle were attributed to decreases in host type due to past outbreaks and extensive wildfires. The 1995 Douglas-fir beetle activity decreased only slightly over that of 1994.

Defoliator populations continue to be at low levels in 1995, with very little visible defoliation being recorded anywhere in the state.

FOREST DISEASES

Disease-associated tree mortality is usually not as apparent as mortality caused by insect outbreaks and forest fires. Although losses from diseases are difficult to measure accurately, annual losses may often exceed those caused by either insects and/or fire. The major categories of diseases in Idaho include root diseases, dwarf mistletoes, white pine blister rust, and nursery diseases. All of these can cause serious problems that affect management of forest stands and nurseries throughout the state. Aerial surveys, which are used to detect most insect-related problems, do not usually record recurring disease impacts. Instead, disease impacts are quantified within particular assessment areas where more intensive examinations are conducted.

About the only diseases quantified using aerial surveys are needle diseases that cause foliar discoloration on affected trees. The widespread injury prevalent during 1994 and several previous years was mostly absent during 1995. Extensive needle diseases often run in cycles and may be prominent for a few years and then less noticeable for awhile. All major conifer species in Idaho have their particular foliar pathogens; in the past, most injury has occurred on lodgepole pine, western larch, ponderosa pine, and western white pine. All foliage disease on these species were less during 1995 than recent years.

FOREST INSECTS

BARK BEETLES

MOUNTAIN PINE BEETLE

In northern Idaho, total tree mortality from the mountain pine beetle increased from 3,309 trees on 3,368 acres in 1994 to 6,427 trees on 5,535 acres in 1995 (Table 1a, Figure 1). This increase was anticipated for most bark beetle species. The hot, dry summer of 1994 contributed to tree stress making trees more prone to beetle attack, which is reflected a year later in aerial surveys because of the delay in tree fading.

The most dramatic increase in mountain pine beetle activity occurred in whitebark pine on the Bonners Ferry Ranger District (RD) of the Idaho Panhandle National Forests (IPNFs). On this District 988 faded trees were detected over 1,568 acres in 1995 compared to 94 faded trees over 229 acres in 1994.

In western white pine there was an increase in mountain pine beetle activity on the Idaho Panhandle NFs and around Pend Oreille lake. Low levels of activity were detected in Kootenai Valley Forest Protection District (FPD) and Maggie Creek FPD in 1995; no activity was reported in these areas in 1994. The Clearwater NF, Mica FPD, and Priest Lake reporting area all reported some beetle activity in 1994, but none in 1995.

The largest increase of mountain pine beetle faded lodgepole occurred on the Idaho Panhandle NF's in 1995. Increasing beetle activity in the Avery and Red Ives RD's have prompted District personnel to lay out salvage sales. The St. Joe river basin contains some of the most contiguous and susceptible lodgepole pine in Northern Idaho. As part of the St. Joe Geographic Area Assessment, a Geographic Information System (GIS) assisted analysis of mountain pine beetle hazards in lodgepole pine is being completed. Although there are portions of the basin with concentrated high hazard stands, it is doubtful that beetle populations will build to levels capable of removing all of the lodgepole from the basin.

Smaller increases in mountain pine beetle faded lodgepole pine occurred on the Nez Perce NF, Craig Mountain FPD, and the Pend Oreille reporting area.

Mountain pine beetle faded lodgepole decreased on the Clearwater NF, Cataldo FPD, Kendrick FPD, and Mica FPD.

In ponderosa pine the mountain pine beetle did not cause significant mortality in 1995. Several concentrations of activity were found along the breaks of the Salmon River and on the South Fork of the Clearwater River in the Nez Perce NF. Also, while ground checking the ponderosa pine mortality groups throughout northern Idaho, many of the groups were found to have approximately 10 - 15 percent of the trees killed by the mountain pine beetle. Generally this insect has not caused extensive damage in ponderosa pine in northern Idaho. The exceptions have been when outbreaks in lodgepole pine have depleted that host, then spread into adjacent stands of ponderosa pine. This same phenomenon has been observed to occur in stands of western white pine.

In southern Idaho, a significant increase in activity occurred with 14,400 trees killed in 1995 compared with 4,800 during 1994 (Table 1b, Figure 1). Mortality occurred in both lodgepole and ponderosa pine. The largest outbreak in southern Idaho continues to be located on the Sawtooth National Recreation Area on the Sawtooth NF in lodgepole pine.

Mortality of whitebark pine attributed to mountain pine beetle activity increased four-fold in 1995. Small isolated infestations are located on National Forests in southern Idaho.

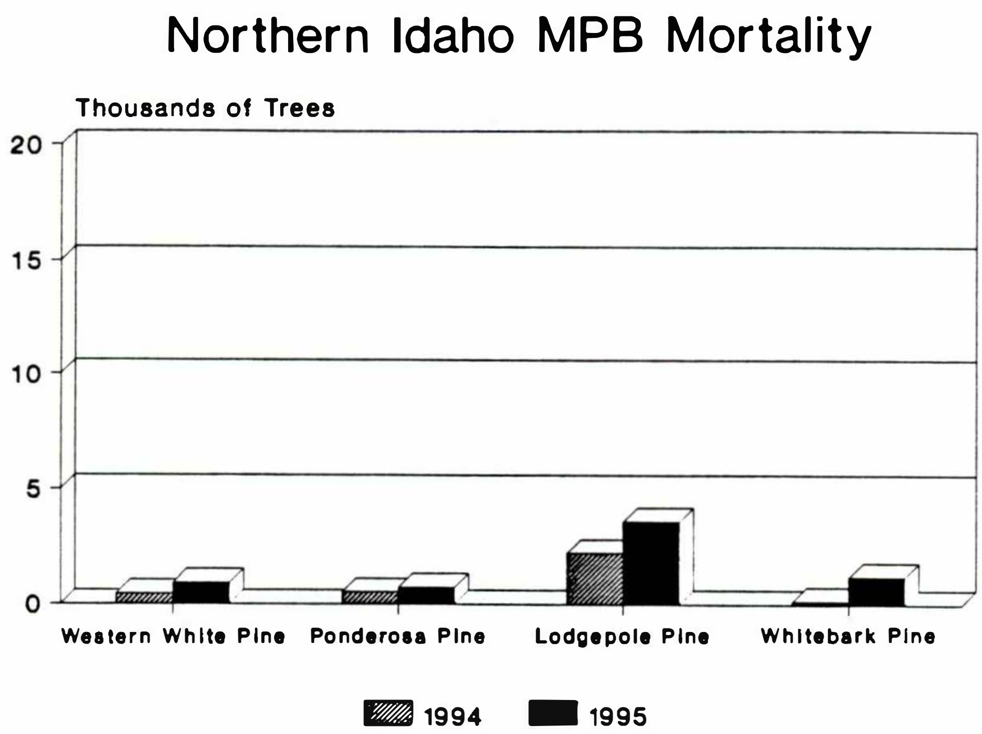
Table 1a. Idaho Statewide summary; annual mountain pine beetle (**MPB**) mortality by reporting area: **Northern Idaho.**

		MPB (white pine) Estimated Mortality			**MPB** (ponderosa pine) Estimated Mortality			**MPB** (lodgepole pine) Estimated Mortality		
AREA	Year	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume
Bitterroot	1995	0	0	0.0	0	0	0.0	2	2	0.2
	1994	0	0	0.0	2	5	0.4	4	3	0.3
Cataldo	1995	2	3	1.2	0	0	0.0	0	0	0.0
	1994	6	4	1.6	2	6	0.5	10	15	1.3
Clearwater	1995	0	0	0.0	0	0	0.0	4	20	1.8
	1994	36	44	17.6	106	100	8.0	67	174	15.7
CPTPA*	1995	0	0	0.0	2	20	1.6	2	20	1.8
	1994	0	0	0.0	0	0	0.0	0	0	0.0
Craig Mtns.	1995	0	0	0.0	113	50	4.0	132	475	42.8
	1994	0	0	0.0	0	0	0.0	45	210	18.9
Panhandle	1995	571	819	327.6	38	100	8.0	2,436	2,124	191.2
	1994	385	373	149.2	59	64	5.1	1,309	1,045	94.0
Kendrick	1995	0	0	0.0	0	0	0.0	0	0	0.0
	1994	0	0	0.0	0	0	0.0	4	15	1.3
Kootenai Valley	1995	4	6	2.4	0	0	0.0	0	0	0.0
	1994	0	0	0.0	0	0	0.0	0	0	0.0
Maggie Creek	1995	0	0	0.0	0	0	0.0	0	0	0.0
	1994	0	0	0.0	2	3	0.2	0	0	0.0
Mica	1995	0	0	0.0	0	0	0.0	0	0	0.0
	1994	2	1	0.4	0	0	0.0	10	42	3.8
Nez Perce	1995	6	6	2.4	62	565	45.2	364	696	62.6
	1994	8	12	4.8	110	130	10.4	550	510	45.9
Pend Oreille	1995	31	77	30.8	0	0	0.0	0	0	0.0
	1994	4	2	0.8	4	15	1.2	134	123	11.1
Priest Lake	1995	0	0	0.0	0	0	0.0	0	0	0.0
	1994	2	2	0.8	51	95	7.6	0	0	0.0
West St. Joe	1995	0	0	0.0	0	0	0.0	0	0	0.0
	1994	0	0	0.0	0	0	0.0	0	0	0.0
Coeur d'Alene IR	1995	0	0	0.0	0	0	0.0	0	0	0.0
	1994	0	0	0.0	133	100	8.0	0	0	0.0
Nez Perce IR	1995	0	0	0.0	0	0	0.0	44	235	21.2
	1994	0	0	0.0	0	0	0.0	14	70	6.3
North Idaho Totals	1995	**620**	**914**	**365.6**	**216**	**735**	**58.8**	**2,984**	**3,572**	**321.5**
	1994	443	438	175.2	469	518	41.4	2,146	2,207	198.6

* Clearwater-Potlatch Timber Protective Association

Table 1b. Idaho Statewide summary; annual mountain pine beetle (**MPB**) mortality by reporting area: **Southern Idaho.**

		MPB (whitebark pine) Estimated Mortality			**MPB** (ponderosa pine) Estimated Mortality			**MPB** (lodgepole pine) Estimated Mortality		
AREA	Year	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume
Boise	1995	75	105	11.6	0	0	0.0	390	450	28.8
	1994	70	98	10.8	0	0	0.0	10	25	1.5
Caribou	1995	85	115	12.7	5	10	0.4	85	140	9.0
	1994	0	0	0.0	0	0	0.0	0	0	0.0
Challis	1995	45	40	4.4	0	0	0.0	770	1,530	97.9
	1994	125	151	16.6	0	0	0.0	240	362	21.7
Payette	1995	85	120	13.2	0	0	0.0	65	125	8.0
	1994	0	0	0.0	0	0	0.0	0	0	0.0
Salmon	1995	0	0	0.0	2,040	2,290	91.6	100	85	5.4
	1994	20	28	3.1	2,066	1,855	74.2	110	156	9.4
Sawtooth	1995	35	50	5.5	0	0	0.0	3.350	4,100	262.4
	1994	145	203	22.3	0	0	0.0	758	1,067	64.0
Targhee	1995	10	40	4.4	0	0	0.0	70	100	6.4
	1994	0	0	0.0	0	0	0.0	0	0	0.0
State	1995	0	0	0.0	5	10	0.4	5,085	1,110	71.0
	1994	0	0	0.0	0	0	0.0	0	0	0.0
Indian Res.	1995	0	0	0.0	0	0	0.0	15	15	1.0
	1994	0	0	0.0	0	0	0.0	0	0	0.0
BLM	1995	0	0	0.0	0	0	0.0	0	0	0.0
	1994	0	0	0.0	0	0	0.0	0	0	0.0
Other Lands	1995	0	0	0.0	0	0	0.0	0	0	0.0
	1994	0	0	0.0	0	0	0.0	0	0	0.0
South Idaho	1995	335	470	51.7	2,050	2,310	92.4	9,930	7,655	489.9
Totals	1994	360	480	52.8	2,066	1,855	74.2	1,118	1,610	103.0
State Totals	1995	**2,050**	**1,676**	**184.4**	**2,266**	**3,045**	**151.2**	**12,914**	**11,227**	**811.4**
	1994	803	918	101.0	2,535	2,373	115.6	3,264	3,817	301.6
State Totals	1995	**620**	**914**	**365.6**						
(white pine)	1994	443	438	175.2						



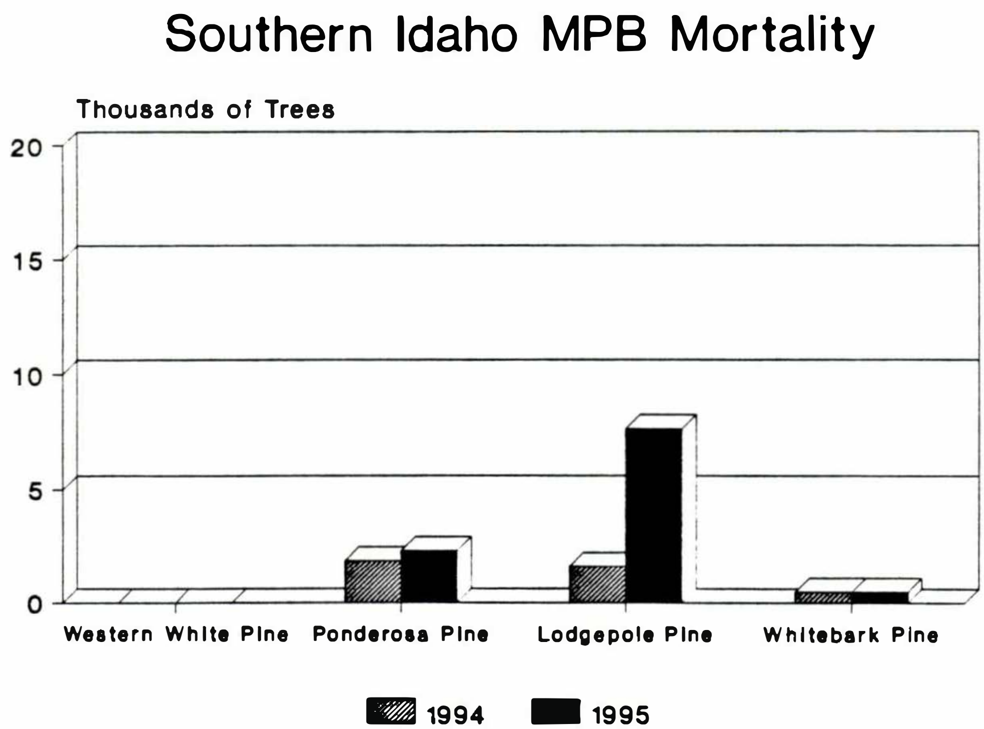


Figure 1. Mountain Pine Beetle Mortality
by Host Species as determined by Aerial Surveys in
Northern and Southern Idaho 1994 - 1995

PINE ENGRAVER\WESTERN PINE BEETLE

In northern Idaho overall, recorded mortality of pines caused by the pine engraver and the western pine beetle increased substantially in 1995 (Table 2a, Figure 2), with the combined totals going from more than 13,800 trees in 1994 to more than 51,800 in 1995. We feel that this increase is mainly due to the extremely hot, dry summer in 1994. Many pines faded in 1994 after the surveys were completed. While some of these trees undoubtedly lost their needles prior to the surveys in 1995, those that faded late in the year would have been included in the 1995 counts.

For the pine engraver, approximately 1/3 of the recorded 34,503 killed trees were small, two-four inch diameter lodgepole pine. These were found primarily in the Rathdrum Prairie area from Coeur d'Alene to Sandpoint. These trees were attacked in tight groups that were easy to detect from the air. The remaining attacks were in ponderosa pine, with the percent of trees killed by this beetle down compared to 1994 when almost all dead pine trees had been killed by the pine engraver.

Ground checking of dead ponderosa pine groups in 1995 found that approximately 50 percent of the trees had been killed by the western pine beetle. Compared to information from ground observations made after the 1994 surveys were finished, this is an increase in the percent of trees killed by this beetle, and as seen in (Table 2a), it is also a significant increase in the overall activity going from 8,239 western pine beetle (WPB) killed trees in 1994 to 17,318 in 1995. With these high populations, there could be continued increases in activity in 1996 by this beetle.

Western pine beetle activity increased on the Boise, Payette, and Sawtooth NFs in southern Idaho. Approximately 8,900 trees were killed in 1995 compared to 6,300 in 1994 (Table 4b, Figure 4). Pine engraver beetle activity was frequently associated with western pine beetle infestations. Mortality due to pine engraver beetle remained low throughout southern Idaho. (Table 2b, Figure 2).

RED TURPENTINE BEETLE

New sites were evaluated for red turpentine beetle attacks in recently pruned western white pine plantations on the Three Rivers RD, Kootenai NF and on the Priest Lake RD, Idaho Panhandle NFs in 1995. We randomly sampled 100 pruned white pine trees in plantations on each district.

On the Priest Lake RD, four plantations were surveyed. Two of the plantations contained no red turpentine beetle attacks, one had 2 percent of the trees attacked, and one had 5 percent of the trees attacked. No tree mortality due to the beetle was observed in any of the plantations.

On the Three Rivers RD, five plantations were surveyed. Red turpentine beetle attacked trees ranged from 0-8 percent in the 5 plantations. However, outside of our 100 tree samples we observed many more attacked trees and tree mortality due to the red turpentine beetle, armillaria root disease, or a combination of both. In pockets of poor rocky soils, an estimated 15-20 percent of trees were attacked and killed by red turpentine beetles without evidence of any other agent. Tree mortality and number of red turpentine beetle attacks were low enough not to be of concern in these stands. However, since high beetle-caused tree mortality has occurred elsewhere, monitoring of recently pruned white pine stands should continue in the future. For more information, see Summary of Insect and Disease Projects (pg. 32).

SPRUCE BEETLE

Spruce beetle activity was low again in northern Idaho in 1995. Only 170 faded trees were detected on 121 acres (Table 2b, Figure 2), a slight increase from 1994 when 64 trees were detected on 108 acres. In 1995 activity was mainly confined to the Idaho Panhandle and Nez Perce NFs where small groups were found on many Ranger Districts. Spruce beetle was not reported in the Nez Perce NF in 1994; in 1995 67 trees were faded on 75 acres over four Ranger Districts.

Mortality from spruce beetle infestation decreased significantly during 1995. This decrease was attributed to a decline in host type on the Payette NF (Table 3), due to recent outbreaks and extensive wildfire in infested areas. No significant mortality was reported on any other forest in southern Idaho.

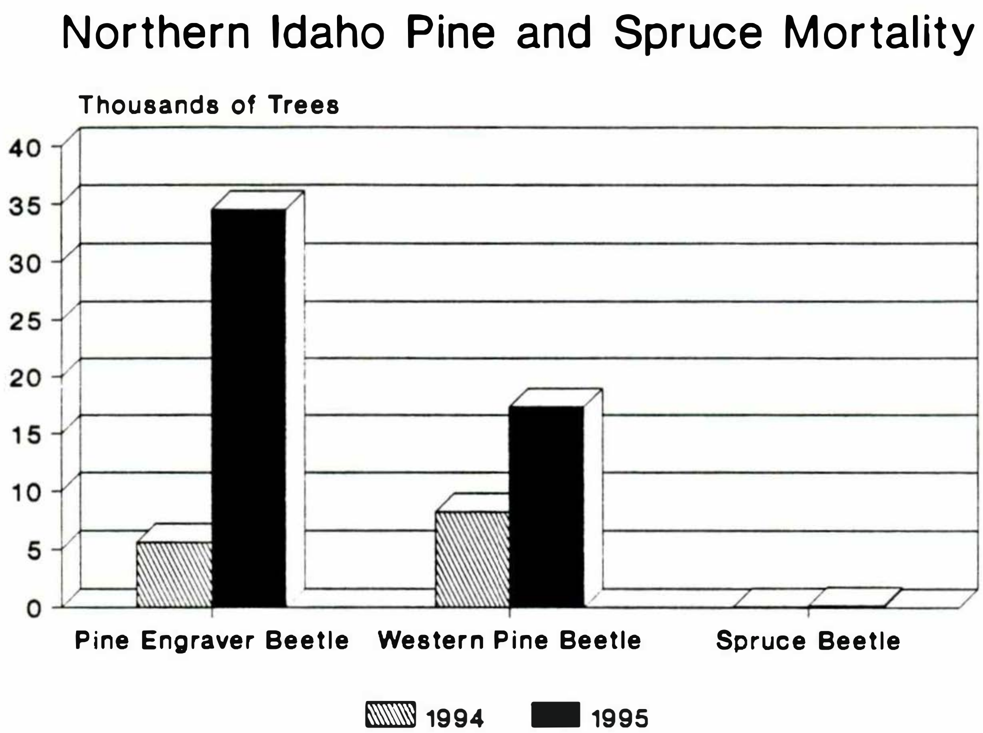
Table 2a. Idaho Statewide summary; annual bark beetle mortality by reporting area: **Northern Idaho.**

		Pine Engraver Beetle Estimated Mortality(PP&LPP)			Western Pine Beetle Estimated Mortality			Spruce Beetle Estimated Mortality		
AREA	Year	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume
Bitterroot	1995	0	0	0.0	0	0	0.0	0	0	0.0
	1994	0	0	0.0	0	0	0.0	2	2	0.8
Cataldo	1995	157	675	16.4	15	64	25.6	0	0	0.0
	1994	2	30	2.7	26	88	35.2	20	10	4.0
Clearwater	1995	1,850	1,550	37.6	60	90	36.0	0	0	0.0
	1994	2	10	0.3	28	66	26.4	61	28	11.2
CPTPA*	1995	139	555	11.9	1,601	1,336	534.4	0	0	0.0
	1994	41	100	2.5	63	345	138.0	0	0	0.0
Craig Mtns.	1995	138	925	23.2	3,041	7,264	2,905.6	0	0	0.0
	1994	16	215	6.3	155	725	290.0	0	0	0.0
Panhandle	1995	392	1,518	36.5	229	285	114.0	44	102	40.8
	1994	15	37	3.0	279	459	250.0	25	24	9.6
Kendrick	1995	8,201	5,735	139.3	93	532	212.8	0	0	0.0
	1994	2	25	0.6	62	353	183.6	0	0	0.0
Kootenai Valley	1995	86	1,370	34.3	26	84	33.6	0	0	0.0
	1994	0	0	0.0	6	8	3.2	0	0	0.0
Maggie Creek	1995	17	215	5.4	111	401	160.4	0	0	0.0
	1994	0	0	0.0	44	236	94.4	0	0	0.0
Mica	1995	726	5,520	127.1	175	550	220.0	0	0	0.0
	1994	220	2,451	212.2	207	1,142	456.8	0	0	0.0
Nez Perce	1995	298	2,762	69.1	461	958	383.2	75	67	26.8
	1994	55	91	2.3	473	582	232.8	0	0	0.0
Pend Oreille	1995	837	6,468	134.3	44	165	66.0	0	0	0.0
	1994	144	2,131	189.9	158	480	192.0	0	0	0.0
Priest Lake	1995	43	545	13.5	2	5	2.0	0	0	0.0
	1994	0	0	0.0	20	65	26.0	0	0	0.0
West St. Joe	1995	194	825	13.9	258	121	48.4	0	0	0.0
	1994	2	10	0.9	36	105	42.0	0	0	0.0
Coeur d'AleneIR	1995	1,559	3,980	99.0	42	90	36.0	0	0	0.0
	1994	0	0	0.0	58	206	82.4	0	0	0.0
Nez Perce IR	1995	1,817	1,890	46.4	496	5,373	2,149.2	2	1	0.4
	1994	38	500	12.5	1,890	3,379	1,351.6	0	0	0.0
North Idaho Totals	1995	**16,454**	**34,503**	**813.2**	**8,049**	**17,318**	**6,927.2**	**121**	**170**	**68.0**
	1994	537	5,600	433.6	2,111	8,239	3,295.6	108	64	25.6

* Clearwater-Potlatch Timber Protective Association.

Table 2b. Idaho Statewide summary; annual bark beetle mortality by reporting area: **Southern Idaho.**

		Pine Engraver Beetle Estimated Mortality			**Western Pine Beetle** Estimated Mortality			**Spruce Beetle** Estimated Mortality		
AREA	Year	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume
Boise	1995 1994	875 750	800 750	8.0 7.5	2,625 2,250	2,400 2,250	1,320.0 1,237.5	0 0	0 0	0.0 0.0
Caribou	1995 1994	0 0	0 0	0.0 0.0	0 0	0 0	0.0 0.0	0 0	0 0	0.0 0.0
Challis	1995 1994	0 0	0 0	0.0 0.0	0 0	0 0	0.0 0.0	0 0	0 0	0.0 0.0
Payette	1995 1994	650 200	800 275	8.0 2.8	1,950 600	2,400 825	1,320.0 453.8	500 4,800	800 8,700	382.4 4,176.0
Salmon	1995 1994	0 0	0 0	0.0 0.0	0 0	0 0	0.0 0.0	0 0	0 0	0.0 0.0
Sawtooth	1995 1994	50 100	175 75	1.8 0.8	150 300	525 225	288.8 123.8	0 0	0 0	0.0 0.0
Targhee	1995 1994	0 0	0 0	0.0 0.0	0 0	0 0	0.0 0.0	0 0	0 0	0.0 0.0
State	1995 1994	409	454	4.5	1,226	1,360	748.0	103	86	41.1
Indian Res.	1995 1994	0	0	0.0	0	0	0.0	0	0	0.0
BLM	1995 1994	4	2	0.1	11	7	0.1	0	0	0.0
Other Lands	1995 1994	0 0	0 0	0.0 0.0	0 0	0 0	0.0 0.0	0 0	0 0	0.0 0.0
South Idaho Totals	1995 1994	1,988 1,050	2,231 1,100	22.3 11.0	5,962 5,400	6,692 4,725	3,680.6 2,598.8	603 4,800	886 8,700	423.5 4,176.4
State Totals	**1995** 1994	**18,442** 4,059	**36,734** 12,167	**835.5** 234.9	**14,011** 7,511	**24,010** 12,964	**10,607.8** 5,894.4	**724** 4,908	**1,056** 8,764	**491.5** 4,201.6



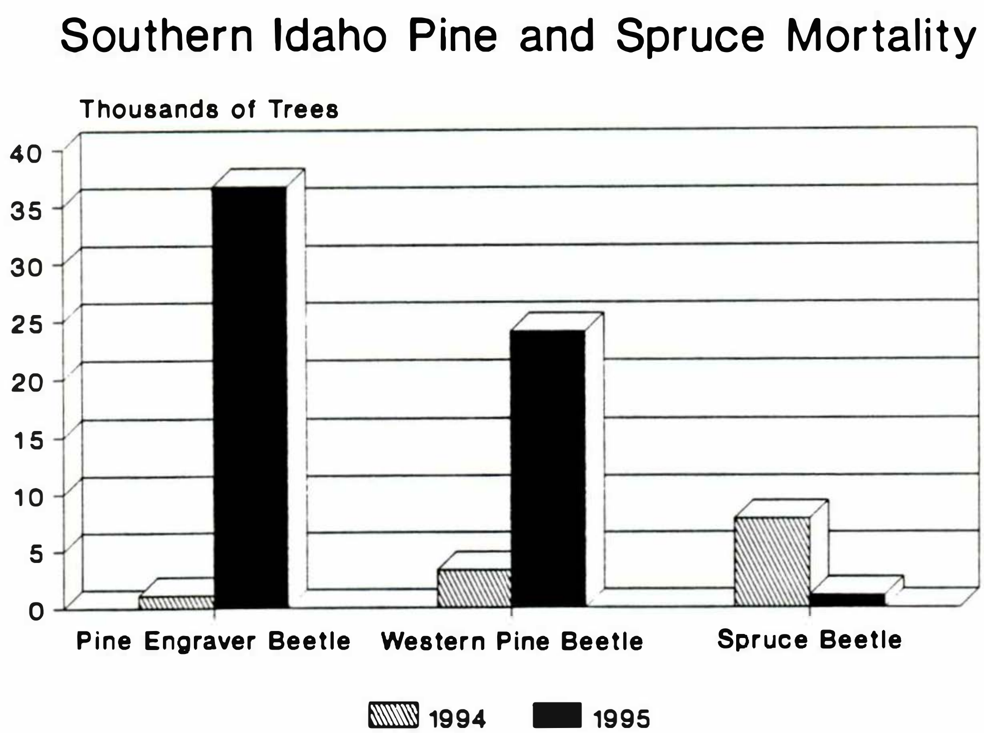


Figure 2. Pine and Spruce Mortality
by Bark Beetle Species as determined by Aerial Surveys in
Northern and Southern Idaho 1994 - 1995

Table 3. Estimated spruce beetle caused mortality, 1985 - 1995

		ESTIMATED MORTALITY		
Forest and Adjacent Lands	YEAR	Acres Infested	Trees	MBF Volume
Boise	1985	55	84	40.2
	1986	--	1,095	523.4
	1987	607	669	319.8
	1988	155	254	121.4
	1989	175	227	108.5
	1990	100	40	19.1
	1991	0	0	0.0
	1992	571	141	67.4
	1993	500	500	239.0
	1994	0	0	0.0
	1995	0	0	0.0
Payette	1985	3,881	13,775	6,584.4
	1986	--	12,600	6,022.8
	1987	13,002	15,873	7,587.3
	1988	36,364	44,756	21,393.4
	1989	26,451	32,108	15,347.6
	1990	152,810	185,460	88,649.9
	1991	36,100	23,800	11,376.4
	1992	31,155	31,719	15,161.7
	1993	35,600	35,200	16,825.6
	1994	4,600	8,700	4,158.6
	1995	500	800	382.4
Totals	**1985-1995**	**342,626**	**407,801**	**194,928.9**

DOUGLAS-FIR BEETLE

In 1995 8,729 faded trees were detected on 15,182 acres, up from 7,367 faded trees on 2,487 acres in 1994. Results by reporting area were mixed; some areas reported increases in acres and trees faded in 1995, others showed decreases, while others showed increases in acres and decreases in faded trees and vice versa (Table 4a, Figure 4). The Kendrick FPD had the largest overall increase in beetle activity. The Clearwater NF reported fewer faded trees, but a substantially larger acreage affected in 1995. The Nez Perce NF reported more faded trees on fewer acres in 1995. There is no clear trend in Douglas-fir beetle activity in northern Idaho in 1995.

Douglas-fir beetle mortality decreased slightly with outbreaks located on the Boise, Sawtooth, and Payette NFs (Table 4b, Figure 4) in southern Idaho.

FIR ENGRAVER

In northern Idaho fir engraver infested stands increased dramatically in response to abnormally warm and dry weather throughout the summer of 1994. In 1994, approximately 7,000 acres of infestation were recorded in northern Idaho, while in 1995 the figure is over 242,000 acres (Table 4a, Figure 4) the largest concentrations of fir engraver were found on the Clearwater and Idaho Panhandle NFs and on adjacent state and private lands and the Coeur d'Alene Indian Reservation. However, most reporting areas had significant infestations. The total number of recorded dead trees increased from 7,841 in 1994 to 156,966 in 1995. This is the highest total number of fir engraver killed trees recorded since 1980 for State, private and Federal lands. (Figure 3).

In southern Idaho, significant decreases in activity occurred on the Boise and Payette NFs, and on adjacent State and private lands. Only 400 trees were killed in southern Idaho in 1995 compared to 4,400 trees in 1994 (Table 4b, Figure 4).

WESTERN BALSAM BARK BEETLE

In northern Idaho 13,834 trees on 7,748 acres were mapped as Western Balsam Bark Beetle killed in 1995, up from 3,910 trees on 2,882 acres in 1994. With the exception of St. Maries RD on the Idaho Panhandle NFs, affected districts on the Nez Perce and Idaho Panhandle NFs show large increases in numbers of faded trees and acres impacted (Table 4a, Figure 4). The Cataldo FPD also showed a dramatic increase, from five trees on two acres in 1994 to 722 trees on 376 acres in 1995. Other reporting areas showed less substantial increases. The Clearwater NF was the only reporting area with a substantial decrease in Western Balsam Bark Beetle; from 695 trees on 299 acres in 1994 to five trees on two acres in 1995.

Pheromone traps were deployed in the Trout Creek drainage (Bonners Ferry RD, Idaho Panhandle NFs) for the third year in a row. Trap catches indicate a continuing reduction of beetle populations in Trout Creek. Refer to the special project section for results.

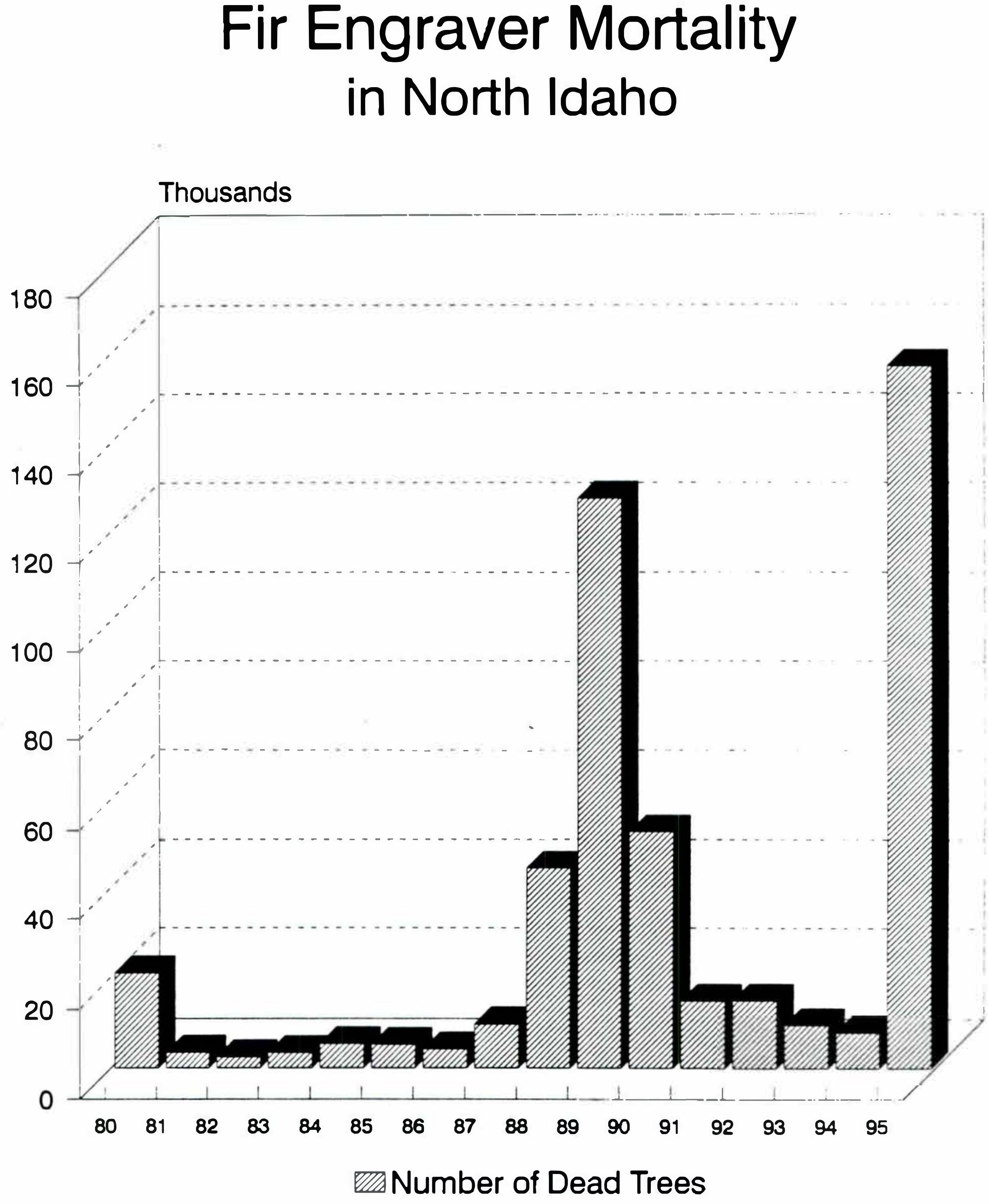


Figure 3. Mortality Caused by the Fir Engraver
as determined by Aerial Surveys in
North Idaho 1980- 1995

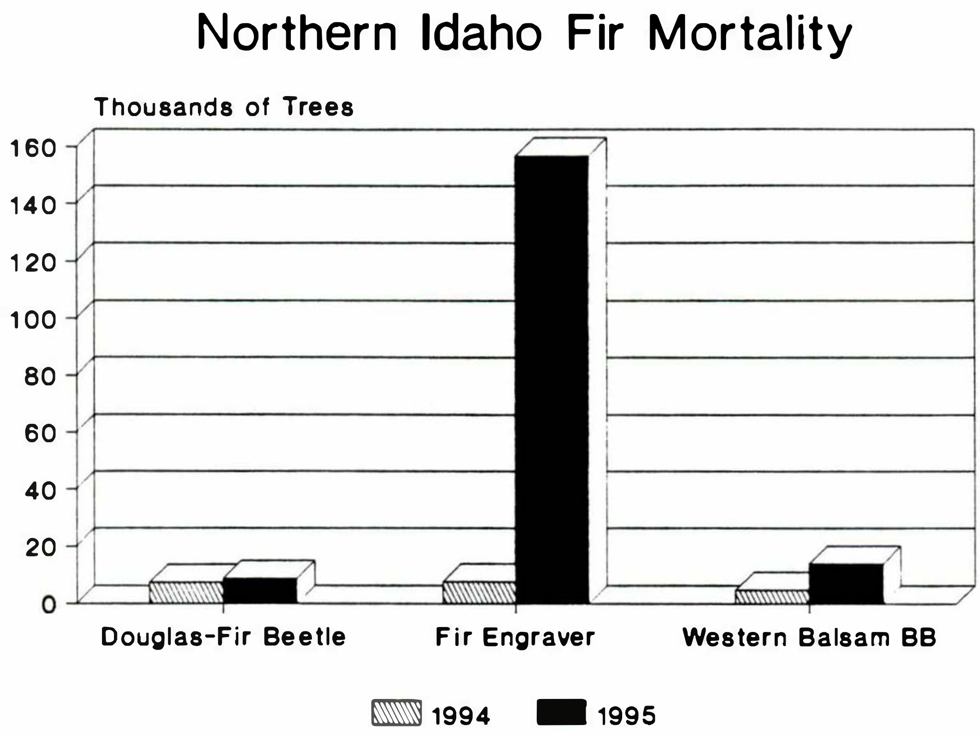
Table 4a. Idaho Statewide summary; annual bark beetle mortality by reporting area: **Northern Idaho.**

		Douglas-Fir Beetle Estimated Mortality			Fir Engraver Estimated Mortality			Western Balsam Bark Beetle Estimated Mortality		
AREA	Year	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume
Bitterroot	1995	0	0	0.0	0	0	0.0	2	1	0.1
	1994	156	532	186.2	0	0	0.0	0	0	0.0
Cataldo	1995	48	200	70.0	8,037	5,059	1,011.8	376	722	79.4
	1994	54	146	51.1	130	327	65.4	2	5	0.6
Clearwater	1995	6,350	2,174	760.9	57,487	33,385	6,677.0	2	5	0.6
	1994	718	2,662	931.7	326	703	140.6	299	695	76.5
CPTPA*	1995	1,681	1,247	436.5	28,370	15,143	3,028.6	2	5	0.6
	1994	130	660	231.0	58	155	36.0	0	0	0.0
Craig Mtns.	1995	0	0	0.0	163	640	128.0	0	0	0.0
	1994	24	70	24.5	30	90	18.0	0	0	0.0
Panhandle	1995	420	856	299.6	27,888	23,398	4,679.6	4,527	7,425	816.8
	1994	647	1,531	535.9	1,685	1,673	334.6	1,912	2,254	247.9
Kendrick	1995	5,646	1,244	435.4	53,500	24,083	4,816.6	0	0	0.0
	1994	8	40	14.0	40	135	27.0	0	0	0.0
Kootenai Valley	1995	16	31	10.9	362	1,314	262.8	0	0	0.0
	1994	2	12	4.2	4	11	2.2	0	0	0.0
Maggie Creek	1995	42	135	47.3	1,271	1,105	221.0	0	0	0.0
	1994	16	53	18.5	316	93	18.6	2	2	0.2
Mica	1995	8	19	6.7	1,772	4,388	877.6	0	0	0.0
	1994	12	30	10.5	120	281	56.2	0	0	0.0
Nez Perce	1995	277	962	336.7	1,649	2,600	520.0	2,769	5,266	579.3
	1994	424	652	228.2	4,023	3,301	660.2	610	714	78.5
Pend Oreille	1995	26	81	28.4	442	2,275	455.0	8	35	3.9
	1994	38	105	36.8	46	121	24.2	0	0	0.0
Priest Lake	1995	14	60	21.0	46	185	37.0	60	370	40.7
	1994	59	230	80.5	10	25	5.0	67	240	26.4
West St. Joe	1995	326	518	181.3	30,352	17,822	3,564.4	2	5	0.6
	1994	150	480	168.0	206	706	141.2	0	0	0.0
Coeur d'AleneIR	1995	92	415	145.3	26,867	23,360	4,672.0	0	0	0.0
	1994	32	140	49.0	50	160	32.0	0	0	0.0
Nez Perce IR	1995	140	518	181.3	4,145	2,210	442.0	0	0	0.0
	1994	15	20	7.0	18	60	12.0	0	0	0.0
North Idaho Totals	1995	**15,182**	**8,729**	**3,055.2**	**242,351**	**156,966**	**31,393.2**	**7,748**	**13,834**	**1,521.7**
	1994	2,485	7,363	2,577.0	7,063	7,841	1,568.2	2,882	4,692	516.1

* Clearwater-Potlatch Timber Protective Association

Table 4b. Idaho Statewide summary; annual bark beetle mortality by reporting area: Southern Idaho.

		Douglas-Fir Beetle Estimated Mortality			Fir Engraver Beetle Estimated Mortality			Western Balsam Bark Beetle Estimated Mortality		
AREA	Year	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume
Boise	1995 1994	9,500 16,300	12,400 18,100	1,760.8 2,534.0	600 1,400	200 500	38.0 95.0	8,900 4,800	8,100 3,200	891.0 352.0
Caribou	1995 1994	1,400 900	1,800 1,600	255.6 224.0	0 0	0 0	0.0 0.0	11,000 4,800	14,000 12,100	1,540.0 1,331.0
Challis	1995 1994	100 100	400 200	56.8 28.0	0 0	0 0	0.0 0.0	1,500 500	3,000 700	330.0 77.0
Payette	1995 1994	1,300 2,200	2,200 4,000	312.4 560.0	0 0	0 0	0.0 0.0	200 1,000	300 1,400	33.0 154.0
Salmon	1995 1994	500 800	500 1,400	71.0 198.8	0 0	0 0	0.0 0.0	300 400	400 600	44.0 66.0
Sawtooth	1995 1994	12,400 13,900	14,100 16,800	2,002.2 2,352.0	0 0	0 0	0.0 0.0	26,100 23,100	28,000 26,700	3,080.0 2,937.0
Targhee	1995 1994	1,000 900	1,100 1,300	156.2 182.0	0 0	0 0	0.0 0.0	6,800 2,100	7,500 3,800	825.0 418.0
State	1995 1994	2,366	3,300	468.6	140	196	37.2	19,686	13,367	1,470.4
Indian Res.	1995 1994	35	60	8.5	0	0	0.0	3,044	3,219	354.1
BLM	1995 1994	10	14	2.0	0	0	0.0	99	73	8.0
Other Lands	1995 1994	0 0	0 0	0.0 0.0	0 3,900	0 1,000	0.0 190.0	0 11,800	0 12,600	0.0 1,386.0
South Idaho Totals	1995 1994	28,611 35,300	35,874 44,000	5,094.1 6,160.0	740 2,400	396 4,400	75.2 836.0	77,629 48,500	77,959 61,100	8,575.5 6,721.0
State Totals	**1995** 1994	**43,793** 37,785	**44,603** 51,363	**8,149.3** 8,737.0	**243,091** 9,463	**157,362** 12,241	**31,468.4** 2,404.2	**85,377** 51,382	**91,793** 65,792	**10,097.2** 7,235.1



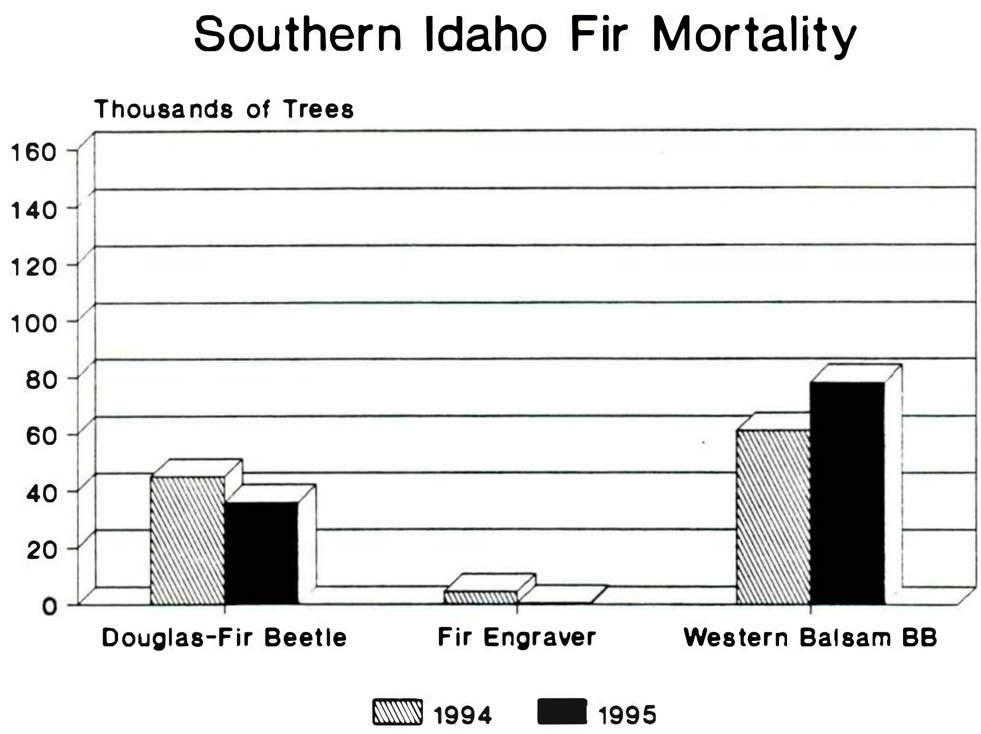


Figure 4. Fir Mortality
by Bark Beetle Species as determined by Aerial Surveys in
Northern and Southern Idaho 1994 - 1995

DEFOLIATORS

DOUGLAS-FIR TUSSOCK MOTH

There continues to be no defoliation due to the Douglas-fir tussock moth in the forested areas of northern Idaho. Only 28 moths were caught in this years pheromone trapping detection surveys in northern Idaho with the highest number being caught near the Mineral Mountain area. (Table 5, Figure 6) Moths were caught at 13 sites. No larvae were detected in lower crown beating samples. The number of homeowners reporting larvae or defoliation of ornamental spruce was as low as 1994. All indicators show that Douglas-fir tussock moth population levels are very low and damage from these insects is unlikely in northern Idaho in 1996. The general trend has taken a moderate increase over that of the last two years. No moths were caught on 30 sites from Lewiston to the Salmon River. Only four moths were caught in ten traps placed in ornamental mature spruce at the Coeur d'Alene Nursery.

In southern Idaho, no visible defoliation from the Douglas-fir tussock moth was observed in 1995.

LODGEPOLE NEEDLEMINER

Approximately 5,015 acres of lodgepole pine were defoliated along Cub Creek near Hunter Peak in the Selway-Bitterroot Wilderness on the Nez Perce NF. The remote location of the defoliation precluded ground surveys to determine the cause in 1995, but the most likely suspect is the lodgepole needleminer. We hope to ground check the area during the 1996 field season. Most of the defoliation was light or moderate, though an area of approximately 600 acres was heavily defoliated.

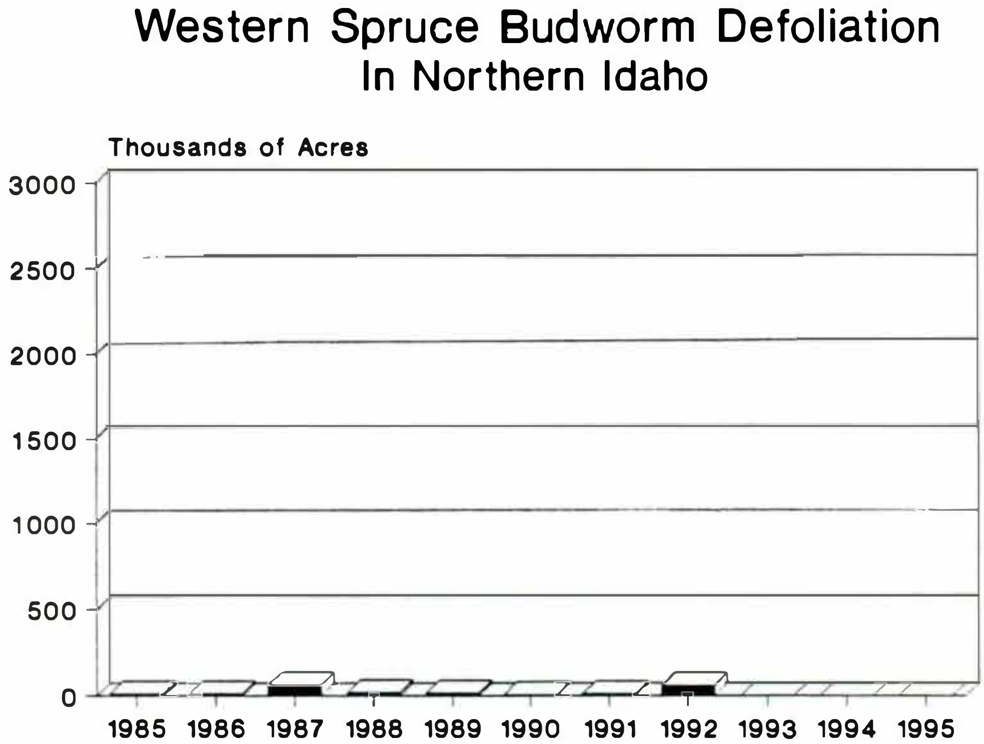
WESTERN SPRUCE BUDWORM

In northern Idaho, no defoliation was detected. On the Nez Perce NF, for the second year in a row, there was no visible defoliation detected (Figure 5) and no moths were caught on 15 sites. Populations are expected to remain low in 1996.

No visible defoliation from western spruce budworm was observed anywhere in southern Idaho during 1995 (Figure 5).

BLACK-HEADED BUDWORM

Approximately 6,589 acres of mountain hemlock were defoliated in the Mallard Larkins Wilderness of the Idaho Panhandle NFs and adjacent Avalanche Creek in the Clearwater NF in 1995. Samples of pupae and moths were collected and tentatively identified as the black-headed budworm. Positive identification was not possible. The budworm may have been **Argyrotaenia** sp., near **gogana** (Kearfott) which defoliated mountain hemlock and other conifers along the Idaho-Montana boarder of the Wallace and Cabinet RDs in the late 1970's and early 1980's. Close examination of the 1994 aerial survey maps show that approximately 800 acres in the Mallard Larkins coded as drought and dieback may have been budworm defoliation and 1995 may have been the second year of budworm activity. We hope to collect additional budworms in 1996 for identification.



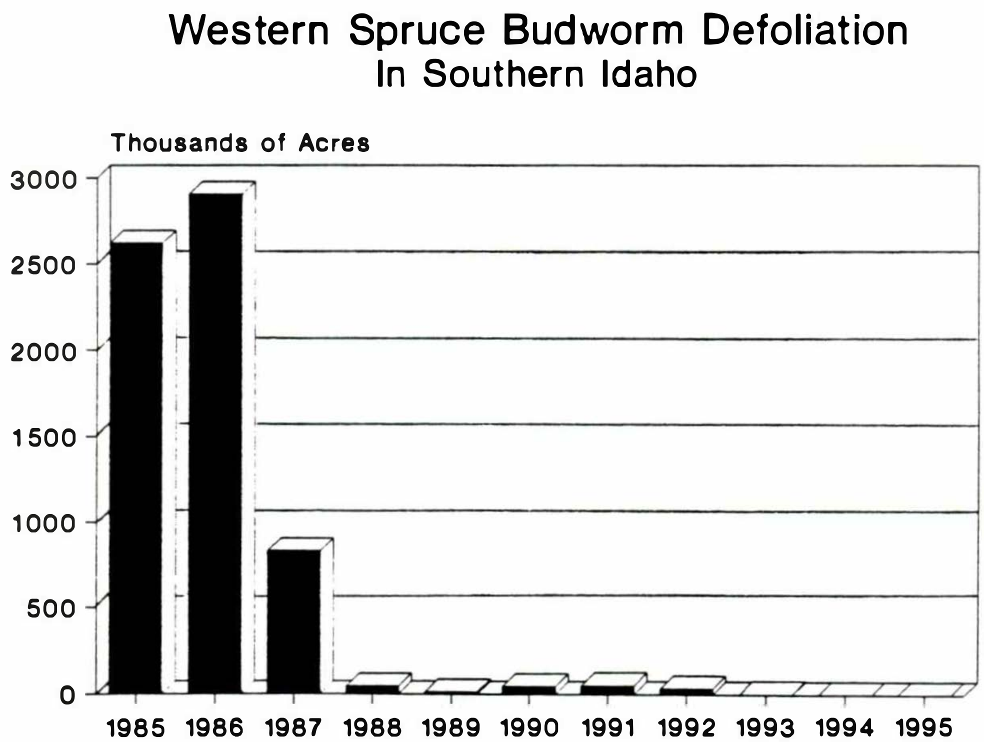


Figure 5. Acres of Western Spruce Budworm defoliation as determined by Aerial Surveys in Northern and Southern Idaho 1985 - 1995

Douglas-Fir Tussock Moth

Table 5. Means of average moth catch per 5 pheromone trap/sample plots in Idaho, 1995-1985

AREA	Number of 1995 sample plots	1995	1994	1993	1992	1991	1990	1989	1988	1987	1986	1985
STATE AND PRIVATE												
Coeur d'Alene	5	0.0	0.0	0.0	0.1	0.0	*	*	*	*	*	*
Coeur d'Alene	5	0.0	0.0	0.0	0.1	0.1	7.2	0.0	0.0	0.2	8.1	9.2
Plummer-Moscow	13	0.3	0.0	0.0	0.7	0.1	0.1	0.0	0.1	1.3	25.6	59.9
Plummer-Moscow	17	0.04	0.1	0.0	0.5	0.1	0.1	0.0	0.0	0.3	15.2	43.3
Plummer-Moscow	8	0.0	0.0	0.0	0.5	0.0	0.1	0.0	0.0	0.5	14.6	32.6
Plummer-Moscow	1	0.2	0.0	0.0	4.0	0.0	0.0	0.0	0.0	1.0	42.8	68.4
Plummer-Moscow	2	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	3.8	49.7	76.0
Plummer-Moscow	3	0.07	0.0	0.0	1.6	0.1	0.1	0.0	0.2	9.0	80.5	*
Plummer-Moscow	14	0.01	0.0	0.0	0.1	0.1	0.2	0.0	0.1	2.2	*	*
Craig Mountain	8	0.0	0.0	0.05	0.5	0.0	0.2	0.0	0.0	0.1	3.5	0.4
NEZ PERCE NF												
Selway RD	5	0.0	0.0	0.04	0.1	0.0	0.4	0.1	0.2	0.0	0.1	0.0
Salmon River RD	5	0.0	0.0	0.08	0.7	2.5	0.1	0.0	0.0	0.0	0.9	0.3
CLEARWATER NF												
Lochsa RD	2	0.0	0.0	0.1	0.2	1.2	0.0	0.2	0.0	0.0	0.3	0.0
Canyon RD	5	0.0	0.0	0.0	0.1	0.3	0.2	0.0	0.0	0.0	1.7	0.9
Pierce RD	5	0.0	0.0	0.16	0.3	0.6	0.3	0.0	0.1	0.1	4.0	0.6
BOISE NF												
Mountain Home RD	11	0.0	0.1	0.0	32.2	68.9	5.3	0.2	0.6	1.4	1.2	0.0
Boise RD	*	*	*	0.0	23.5	59.6	65.6	*	*	*	*	*
Idaho City RD	5	0.0	0.0	0.0	0.6	27.2	*	*	*	*	*	*
Cascade RD	5	0.0	0.0	0.0	0.4	0.7	31.6	0.0	0.2	0.2	1.2	1.0
Lowman RD	10	0.0	0.0	0.0	1.8	20.0	*	*	*	*	*	*
Emmett RD	10	0.0	0.0	0.02	1.2	19.7	*	*	*	*	*	*
PAYETTE NF												
Council RD	12	0.1	0.0	0.0	2.8	6.6	23.2	0.7	1.9	7.4	21.2	5.1
Weiser RD	12	0.1	0.1	0.0	2.4	21.4	67.0	0.8	0.7	5.2	15.2	4.1
New Meadows RD	11	0.0	0.0	0.0	1.6	8.8	*	*	*	*	*	*
McCall Rd	5	0.0	0.0	0.0	0.8	0.7	*	*	*	*	*	*
SALMON NF												
Northfork RD	*	*	*	*	*	*	0.4	0.6	21.3	2.9	6.6	*
SAWTOOTH NF												
Fairfield RD	5	0.0	0.3	0.0	35.3	70.5	80.3	16.5	3.3	13.3	19.7	0.0
OTHER												
Owyhee Mountains	4	13.1	2.0	0.0	51.1	76.1	75.5	12.8	15.8	7.8	9.4	0.6
Sharps Canyon	1	0.0	0.0	0.0	18.8	*	53.2	9.2	36.4	8.4	22.6	5.2
Pine Rdg-Lost Lake	1	0.0	0.0	0.0	5.0	25.0	*	*	*	*	*	*

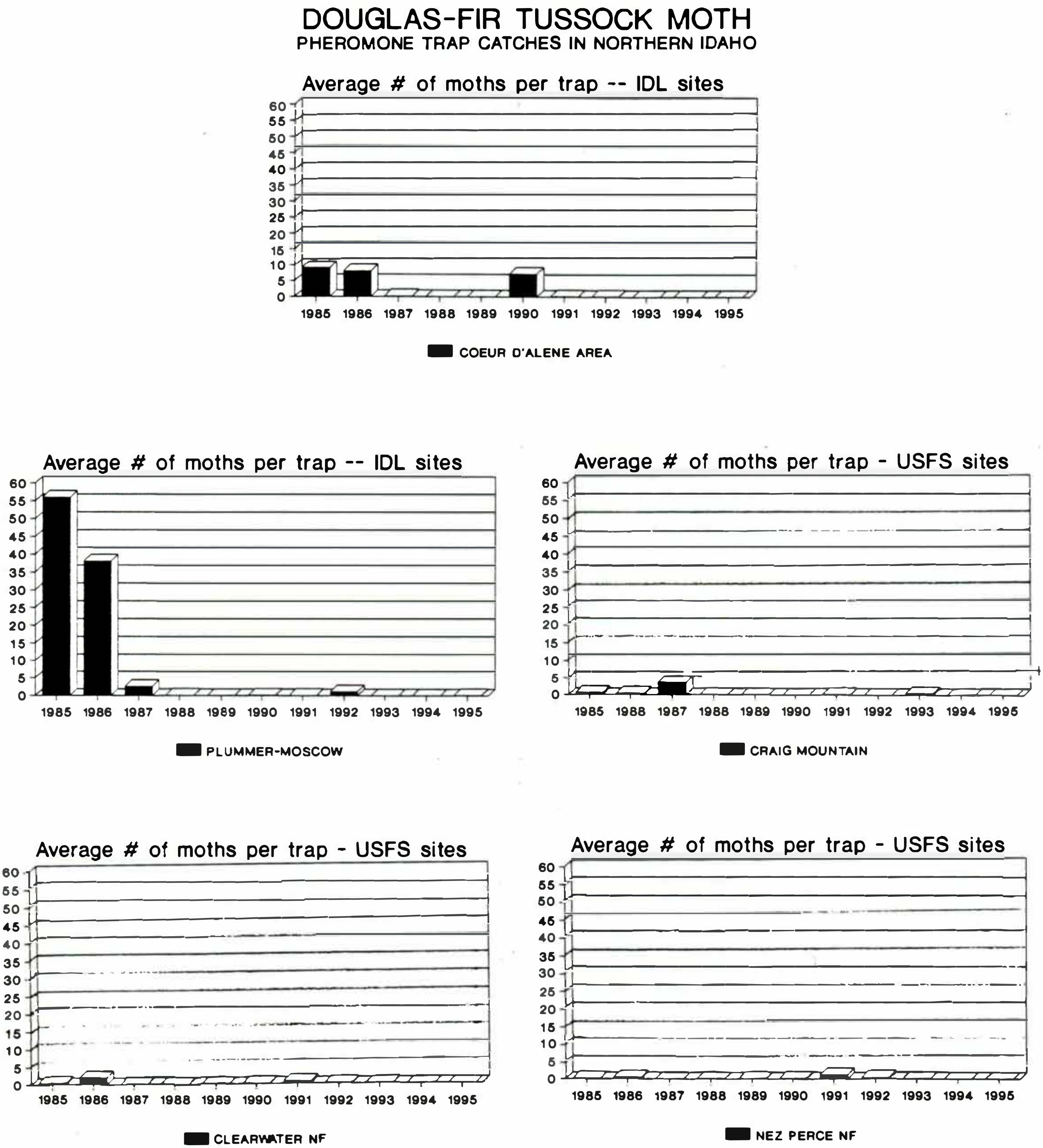


Figure 6. USFS and IDL
Douglas-fir Tussock Moth Trap Catches
in Northern Idaho 1985 - 1995

DOUGLAS-FIR TUSSOCK MOTH
PHEROMONE TRAP CATCHES IN SOUTH IDAHO

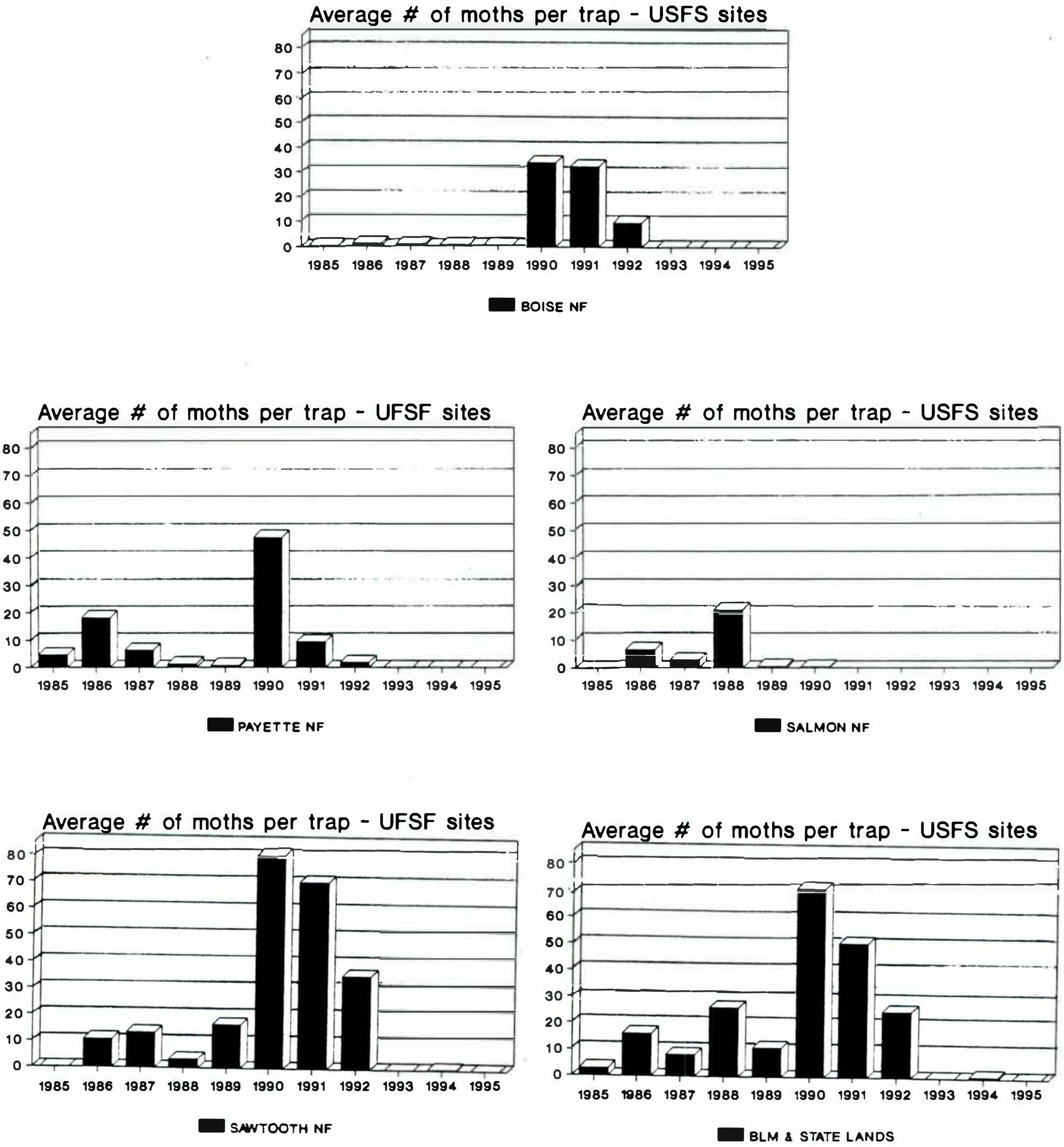


Figure 7. USFS
Douglas-fir Tussock Moth Trap Catches
in Southern Idaho 1985 -1995

GYPSY MOTH

The Idaho gypsy moth detection survey program systematically samples all populated areas of the State in order to detect introductions of gypsy moths. Many USDA Forest Service campgrounds are also sampled, as well as rest stops, tourist attraction sites and other locations where people congregate. High risk areas, those cities with the highest populations and the highest potential for newly arriving families, are trapped each year. Other areas are trapped every other year or every third year. The survey will continue to expand as cities grow and more people move into the rural areas of our state. All trapping results are incorporated into the National Agricultural Pest Information System (NAPIS) database.

DETECTION TRAPPING

One gypsy moth was caught in Idaho in 1995. This moth was in a detection trap located in Post Falls, (northern Idaho) at a small park frequented by tourists.

The Idaho Department of Lands, the Idaho Department of Agriculture and the USDA Forest Service Regions 1 and 4, with participation from APHIS, cooperatively placed approximately 4,600 pheromone baited traps throughout the state in 1995. Our target density for these detection traps is four traps per square mile. Added emphasis is given to cities, towns and rural areas where a sufficient number of new families moved in to generate an increased risk of introduction of gypsy moths. Tracking of these new "move-ins" is provided in a report compiled by the Idaho Department of Transportation showing the locations of people moving to Idaho from gypsy moth infested states. The report, derived from applications for vehicle title transfers, indicates that approximately 250 individuals or families move to Idaho each month from the generally infested states of the Northeast including Virginia, West Virginia and Wisconsin.

Our traps are checked once in mid-season. The check is timed to coincide with peak flight as determined by use of the gypsy moth phenology model, GYMPHEN. Maximum and minimum daily temperatures for representative areas around the state are updated monthly for the model runs.

DELIMITATION TRAPPING

No moths were caught in the delimit traps in 1995. Trapping was done at three sites in Idaho. One hundred seven traps were placed in Coeur d'Alene, surrounding the sites where two moths were caught in 1994 and 20 traps were placed in Pocatello, where a single moth was caught in 1994. Ten delimitation traps were placed in the area immediately surrounding this years catch site in Post Falls. All three of these sites will be delimit trapped again in 1996.

PREVIOUS INFESTATIONS

Eradication of previous infestations of gypsy moths in Sandpoint and in Coeur d'Alene, has now been confirmed for six years. No moths were caught in or close to the treated areas after ground and aerial treatments in 1989 and 1990 with *Bacillus thuringiensis k.*

GPS, GIS, and BAR CODE READING SYSTEM

We are currently using a Trimble, Global Positioning System (GPS) system to record the locations of our traps in northern Idaho. This information will shortly be incorporated into a state-wide GIS system. This allows us to have improved tracking of the traps, and provides maps for use by the trapping personnel. We also have a bar code system developed where each trap has a bar code label that identifies the trap location and trap number. The bar code readers provide for hand entry of trap information such as the number of moths caught. This information is downloaded into our computerized data system.

STATE ADVISORY COMMITTEE

An advisory committee, composed of representatives from the above mentioned agencies and the University of Idaho, reviews activities and provides guidelines for the gypsy moth program in Idaho.

Post Falls, Kootenai County

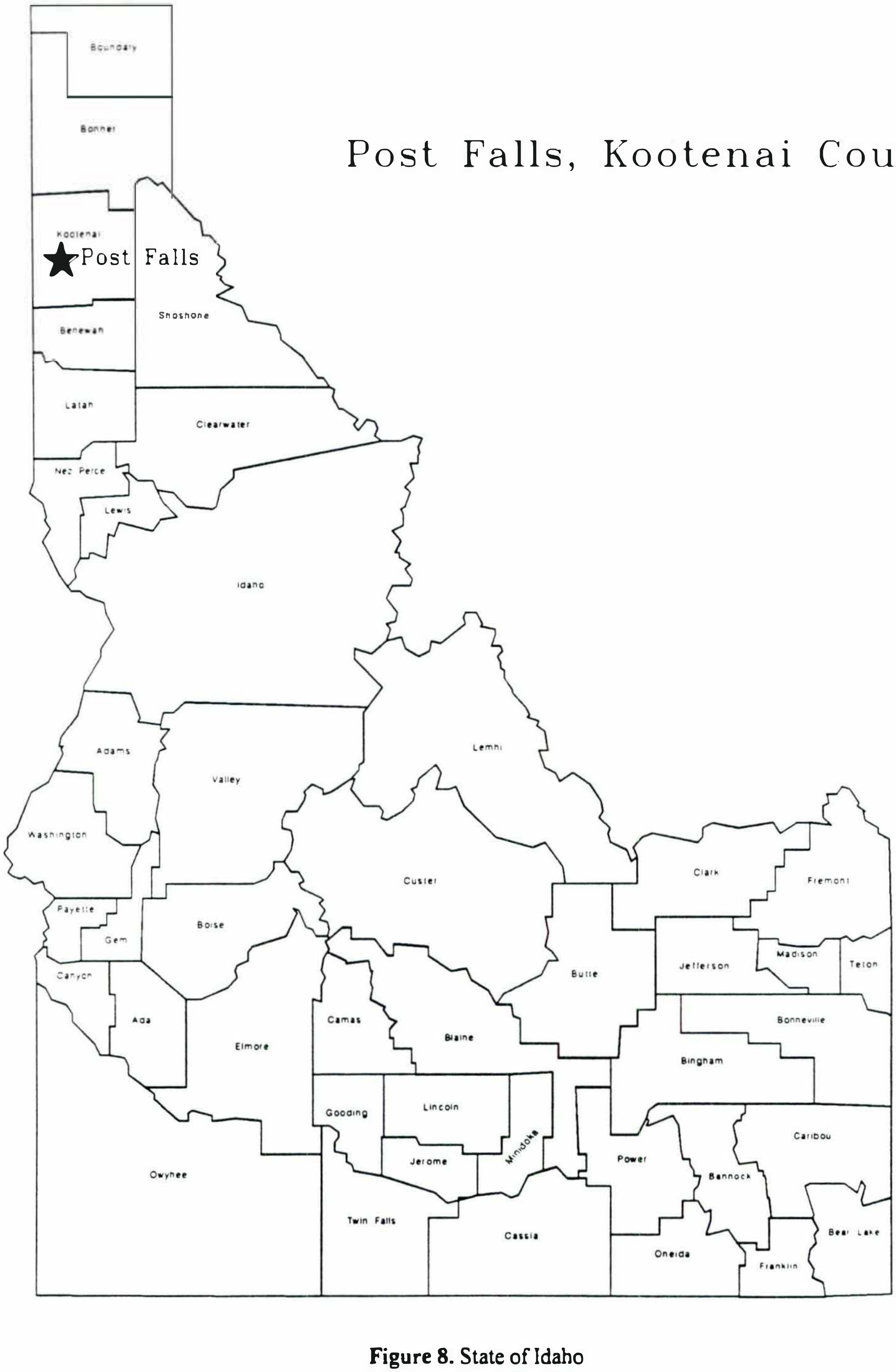


Figure 8. State of Idaho
1995 Gypsy Moth Catch Sites

OTHER INSECTS

BALSAM WOOLLY ADELGID

In September of 1995, Coolwater Ridge near the town of Lowell was revisited as well as sites near the town of Pierce. Coolwater Ridge, a high elevation site (5300 - 6000 feet) had a very active adelgid population with lots of current tree mortality in 1988. In 1995, there was a lot less current fading but an abundance of older mortality. We found some bole infestations with live crawlers, adults, and neosistens (over wintering stage) but it definitely was not as active as it had been. On French Saddle, near Pierce, we also saw older mortality and gouting with a few current faders. On Hemlock Butte, near Pierce, very few individual adelgids were seen on some trees. No adelgid caused mortality was observed there. On a lower elevation creek bottom site on Gold Creek, we found a heavy current population with current as well as older tree mortality.

CRANBERRY GIRDLER MOTH

Cranberry girdler moth trap catches in 1995 at the Coeur d'Alene nursery were the lowest recorded in several years. A total of 982 moths were caught from May 24 - Sept. 8. The highest weekly trap catch was 152 occurring on June 29 compared to a weekly high of 343 moths in 1994 and 807 moths in 1993. All other weekly totals in 1995 were under 80 moths caught. Because of the low trap catch and low damage estimates in 1994, the nursery beds were not sprayed for girdler moth at all in 1995.

An estimate of girdler moth damage out of all discarded seedlings was done by inspectors in the packing shed. In 34 lots of 2-0 Douglas-fir, 91percent of the lots had no damage and 9percent of the lots contained 5percent girdler moth damage. In 103 lots of 2-0 western larch, 93percent of the lots had no girdler moth damage and the remaining 7percent of the lots had damage estimates ranging from 1 to 5percent. These damage levels were considered within acceptable limits.

CONE AND SEED INSECTS

By the abundance of seed bugs entering houses in the fall of 1995, it was a very good year for their survival. Home owners bothered by these insects tried many methods of getting rid of them including vacuuming them off their house siding.

The Coeur d'Alene western white pine seed orchard was examined for cone and seed insects in mid-May and mid-July. Numerous adult seedbugs were observed mating in May. The orchard was sprayed with Pounce® during the last week in May. Both seedbug numphs and adults were abundant again in mid-July. A second treatment was recommended but was unable to be completed. A few cone beetles, coneworms, and adelgids were also observed during the examinations. A total of 1,135 bushels of cones were harvested yielding 240.4 pounds of seed (.21 lb/bu). This was a lower yield than in 1994 and probably due in part to seedbug damage and inadequate pollination.

The Lone Mountain western white pine seed orchard was examined in early August. Only five trees were examined before the bucket truck broke. On those five trees, 170 cones were examined and 14 seedbugs observed. Insecticidal treatment should be considered to protect seed in this orchard in the future. The cones that were harvested yielded 216.5 pounds of seed.

The Grouse Creek white pine orchard was examined in early May and August. Adelgids were observed in May. In August, only 1 percent of the cones examined were infested with coneworms but a high number (11.5 percent) of the cones examined were killed by cone beetles. Cone beetles can be a serious threat to orchard production.

At the old Sandpoint orchard, >90 percent of the cones were destroyed by cone beetles during certain years. Preventive treatment with insecticides should be considered as well as sanitizing infested cones every year. A total of 28.5 bushels of cones were harvested yielding 14.8 pounds of seed (.52 lb/bu).

The western white pine orchard at the Priest River Experimental Forest was examined once in May. Only adelgids were observed on the cones at that time.

The Douglas-fir orchard at Dry Creek was examined in May. About 16 trees were observed with cones. A few cones had frost damage but no cone infesting insects were observed.

In late April, the BLM ponderosa pine orchard at Russell Bar on the Salmon River was examined. Several seed bugs were observed even on a cold rainy day. The orchard was sprayed shortly after on the first day of good spray weather.

The Moscow white pine seed orchard uses pheromone baited traps to monitor biological activity of the cone worms and cone moths. Based on trap catches, a treatment decision was made and the orchard treated with Pounce® on May 8, 1996. Monitoring for the western conifer seed bug began in late May and continued until cone harvest. No confirmed sightings were made and during cone harvest the cone collectors verified that the seed bug populations were much lower than they had been in 1995. As a result, no seed bug treatment was scheduled as has been done in the recent past years. No conelet abortion was observed subsequent to cone harvest, giving support to the decision to not treat for the western conifer seed bug in 1995. Careful observation will need to be made in 1996 to assure the populations do not rebound to damaging numbers.

A total of 1,740 bushels of were collected from the Moscow seed orchard in 1995. An additional 190 bushels of dead and potentially insect infested cones were disposed of as a sanitary measure.

FOREST DISEASES

This narrative is divided into two sections. The first section describes diseases which are known to have changed during 1995. Our most severe disease problems continue to cause widespread damage over much of the same areas every year.

The second section is a table which summarizes disease problems observed in 1995 with brief remarks describing hosts, location and severity.

DWARF MISTLETOES

Dwarf mistletoes are widespread throughout forests in Idaho. In southern Idaho dwarf mistletoes infect 45 percent of the lodgepole pine stands, 33 percent of Douglas-fir stands and 25 percent of ponderosa pine stands. Dwarf mistletoes are not aggressive tree killers but can have very significant impacts on growth.

Estimates for dwarf mistletoe indicate over 700,000 acres are infested with volume losses of over 13 million cubic feet. Dwarf mistletoe management considerations are generally included in Forest plans, and emphasize management through conventional forest management practices. However, there are still some previously harvested stands that qualify for sanitation treatment to eliminate residual infested trees that threaten the regeneration.

ROOT DISEASES

Rough estimates indicate that root disease mortality occurs on nearly two million acres of Idaho forests, causing losses of over 30 million cubic feet. Root diseases continue to be the primary disease concern throughout northern Idaho forests and are the subject of several studies. Please refer to the project summaries in the following pages for the current status of these projects.

VASCULAR WILTS

The city of Boise removed about 40 American elm trees that were infected with Dutch Elm disease in 1995. There are only 1,120 American elms left from a population of over 5,000 twenty years ago when the disease was first diagnosed in the city. They are continuing an aggressive spray program for elm leaf beetles to reduce spread as well as enforcing ordinances to ensure rapid removal of infected trees.

Dutch Elm disease continues to maintain a foothold in Moscow where seven more infected American elms were removed this year. Trees in one city park are continuing to be injected with fungicides to reduce losses. However, Pullman, Washington (six miles to the west) has no program in spite of positive diagnosis of the disease.

FOLIAGE DISEASES

Several foliage disease fungi have been causing broad areas of discoloration for several years on several different hosts. The severity of disease is often a result of a combination of factors, usually related to moisture levels during periods when the diseases need high humidity levels to create new infections.

However, in 1995 foliage diseases were at the lowest level in many years. Lodgepole pine that has suffered severe infections for 4-5 consecutive years in north Idaho were only lightly infected.

The primary needle cast of ponderosa pine, Elytroderma, was also at a low level, although it is a chronic disease, so it continues to be observed in areas that have a history of infection. Eltyroderma is a bit different from most other needle casts in that it can become perennial in the small branches. As the host tissue is invaded, trees produce an abundance of shoots resulting in a "brooming " effect. It takes several years before infections result in brooms, but young infections that kill foliage look much like other needle casts. During favorable weather conditions, new infections can be widespread. However, in 1995, new infections were at a minimum, although brooming continued in trees with older infections.

Diplodia blight of ponderosa pine continues to cause widespread dieback of foliage and small branches throughout much of northern Idaho. Chronic areas with high levels of infection are along the Clearwater river, but infection intensities vary widely from tree to tree in any particular location.

Needle casts that were observed in white pine in 1994 were also at a low level in 1995.

Needle diseases of larch continue to be a minor problem in scattered areas throughout its range in Idaho.

DISEASES OF NURSERIES AND TREE IMPROVEMENT AREAS

1. Needlecast caused by the fungus Rhizosphaera kalkofii was confirmed on several Colorado blue spruce from ornamental growers in northern Idaho near Bonners Ferry and Sandpoint. This disease re-occurs periodically and seems associated with cool, wet spring weather.

2. Botrytis cinerea was located on container-grown ponderosa pine seedlings at the USDA Forest Service Nursery in Coeur d'Alene. This fungus caused stem lesions and is usually infrequently associated with ponderosa pine, although infection of several other conifer species is common.

3. Dieback of ornamental Cornus from growers near Sandpoint yielded presence of Septoria canadensis. This foliage blight fungus also attacks twigs and branches and is associated with cool, wet weather.

4. Ornamental Acer spp. from near Sandpoint were infected with Cytospora chrysosperma. This common canker-causing fungus affects many hardwood species but is most common on Populus spp.

5. Seed of Pinus monticola from blister-rust resistant seed orchards at Coeur d'Alene and Lone Mountain were contaminated with high levels of Fusarium spp. after seed processing and at the time of sowing bareroot and container crops at the USDA Forest Service Nursery in Coeur d'Alene. Infection levels exceeded those normally encountered on conifer seed.

6. Decline and death of grand fir Christmas trees near Sandpoint was caused by interactions between drought conditions during 1993 and secondary insects attacking stressed trees. Phytophthora spp. were suspected but not isolated from declining trees.

7. Ceanothus prostatus seedlings from the Silver Springs Nursery in northern Idaho with damping-off symptoms were extensively infected with Pythium and two species of Cylindrocarpon.

8. Bareroot 1-0 ponderosa pine, lodgepole pine, western larch, Douglas-fir, and bitterbrush seedlings were extensively damaged by soil-borne Fusarium spp. (primarily F. oxysporum) at the USDA Forest Service Lucky Peak Nursery near Boise. Disease was much greater than usual because affected fields could not be fumigated prior to sowing due to very wet spring weather.

9. Swedish aspen (ornamental) seedlings from growers near Sandpoint displayed typical virus infection symptoms. Presence of potentially-pathogenic fungi was not found; the problem was likely due to insect-vectored potyvirus of unknown description.

10. Bareroot 3-0 Douglas-fir seedlings with extensive root decay at the USDA Forest Service Lucky Peak Nursery near Boise were infected with an unidentified species of Phytophthora and Fusarium oxysporum. Damaged seedlings were chlorotic and dwarfed compared to seedlings without root disease symptoms.

11. Fraser fir seedlings from growers near Sandpoint had extensive root disease and stem lesions. Isolations from roots consistently yielded several species of Fusarium; those from edges of lesions yielded an unidentified species of Phytophthora.

COMMON AND RECURRING NURSERY DISEASES

1. The most common and damaging diseases of conifer seedlings in Idaho and Montana nurseries continued to be root diseases caused by Fusarium spp. These fungi caused damping-off, seed decay, and root diseases on many different conifer hosts in both bareroot and container nurseries. The most common soil-borne pathogen in bareroot nurseries was F. oxysporum, although several other species were commonly isolated from infested seed, soil and roots of diseased seedlings. The major pathogen in container nurseries was F. proliferatum, although F. oxysporum and several other Fusarium spp. also occurred at high levels in some nurseries. Fusarium diseases in nurseries were very difficult to control. Although all conifer species were susceptible, most damage occurred on Douglas-fir, western larch, ponderosa pine, western white pine, and Engelmann spruce.

2. Cylindrocarpon destructans caused severe losses to container-grown western white pine at several nurseries. Although damage occurred on other conifer species, root decay of five-needle pines was most serious and efforts to reduce damage were largely unsuccessful.

3. Botrytis cinerea was serious on several conifer species in container nurseries and on stock from storage. Western red cedar, western larch and Engelmann spruce were especially damaged.

4. Tip dieback caused by Sirococcus strobilinus, Sphaeropsis sapinea, and Phoma eupyrena commonly occurred at low levels at most bareroot nurseries. Ponderosa and lodgepole pine were the two most affected species.

5. Pythium root disease usually occurred at low levels at most bareroot nurseries. The most important causal organism was P. ultimum.

STATUS OF CHRONIC DISEASE PROBLEMS

DISEASE	HOST	LOCATION/REMARKS
STEM & BRANCH DISEASES		
Aspen trunk rot	Aspen	Especially common in older aspen stands in southern Idaho.
Atropellis canker	Lodgepole pine	Found in pockets in pole sized stands causing defect, topkill, and some mortality.
Comandra blister rust	Lodgepole pine/ponderosa pine	Most common in SE Idaho; infrequent but may be locally severe.
Cytospora canker	True firs	Increased levels of symptoms, considerable branch flagging, and top-killing in localized areas. Frequently associated with western balsam bark beetle in southern Idaho.
Diplodia blight (Sphaeropsis blight)	Ponderosa pine	Is causing widespread branch dieback in many Idaho areas; especially common in riparian areas.
Dwarf mistletoes	Douglas-fir, western larch, lodgepole and ponderosa pine	Widespread and damaging throughout the state.
Indian paint fungus (Rusty-red stringy rot)	True firs, hemlock	Causes 90 percent of decay in these species throughout the state; especially common as age increases beyond 60 years.
Red ring rot	Western larch, true firs, Douglas-fir, pines, spruce	Can cause serious decay problems in mature conifers.
Stalactiform blister rust	Lodgepole pine	Heavy infection has been observed in localized areas of the Boise, Payette, Sawtooth, and Targhee NF's.
Western gall rust	Lodgepole and ponderosa pine	Occurs throughout the host range; with localized areas of heavy infection.
White pine blister rust	Western white pine, limber pine, whitebark pine	Continues to be a major mortality factor in natural regeneration; becoming a major problem in subalpine pines.

ROOT DISEASES		
Annosus root disease	Pines, true firs, Douglas-fir, spruce	Causes mortality, root and butt rot especially in young trees near old stumps; frequently in complexes with other root diseases; may predispose trees to windthrow and/or bark beetles.
Armillaria root disease	Douglas-fir, grand fir, other conifers especially when young and improperly planted	In north Idaho, a widespread killer of all sizes of trees; In southern Idaho usually found as a weak pathogen or in complexes with other root diseases.
Black stain root disease	Pines, Douglas-fir	Found infrequently in Idaho; caused pinyon pine mortality in southern Idaho; usually in association with other root diseases.
Laminated root rot	Douglas-fir, true firs, occasionally other conifers	Primary killer in many stands from the Nez Perce NF north; may be found with Armillaria or other root diseases.
Schweinitizii root rot	Douglas-fir, pines	Common in mature and overmature forests throughout the state; frequently associated with other root diseases and bark beetles.
Tomentosus root disease	Douglas-fir, subalpine fir, Engelmann spruce, lodgepole pine	Usually found as root/butt rot with other root diseases; occasionally causes mortality. Most common in southern Idaho, but present throughout the state.
FOLIAGE DISEASES		
Conifer-Aspen rust Conifer-Cottonwood rust	Aspen, cottonwood, conifers	Commonly observed on hardwood hosts in southern Idaho; some clones were severely defoliated. Epidemic throughout the host range of all Populus species in 1995.
Rhabdocline needlecast	Douglas-fir	Very widespread but relatively light levels statewide.
Swiss needlecast	Douglas-fir	Widespread in north Idaho; generally at very low levels of infection.
Elytroderma needlecast	Ponderosa pine	Widespread throughout the state but more prevalent in drier climates; new infections were at very low levels in 1995.
Fir broom rust	True firs	Widespread throughout the state; usually of little consequence, but is "extremely common" in stands south of the Snake River in southern Idaho.

Fir needlecast	Subalpine fir Grand fir	Infection occurred at low levels throughout the host type.
Fir needle rust	Subalpine fir	Variable infection levels on young trees throughout host type.
Larch needlecast & blight	Larch	Both diseases occur throughout Idaho. In Northern Idaho infection levels were very low in 1995.
Lodgepole pine needlecast	Lodgepole pine	Widespread throughout Idaho; infection levels dropped dramatically in 1995.
Marssonina blight Shepard's Crook	Aspen	Scattered incidence of light to heavy intensity throughout most of host range.
Pine needle rust	pines	Scattered incidence of light to moderate intensity scattered throughout the host types in southern Idaho.
Spruce broom rust	Engelmann spruce	Scattered through host range; most common in eastern Idaho.
White pine needlecast	Western white pine	Infections declined dramatically in 1995.
NURSERY DISEASES		
Cylindrocarpon	Western white pine whitebark pine	Common in soil or contaminated containers, usually a saprophyte but may be a weak parasite, caused losses at several nurseries.
Diplodia tip blight	pines	Low levels in areas with a history of problems.
Fusarium root disease	Douglas-fir, larch, spruce, others	The most common and widespread nursery disease; amount of damage varies widely.
Grey mold	most conifers, esp. larch, spruce	Common at low levels in many nurseries. Can be a serious storage problem.
Meria needlecast	larch	Infection levels were very low in 1995.
Phoma blight	pines	Commonly isolated from seedlings and soil samples.
Sirococcus tip blight	spruce, pines	Found at low levels at several nurseries.

SUMMARY OF DISEASE AND INSECT PROJECTS

INSECT AND DISEASE TRAINING SESSIONS Each year the IDL and USFS insect and disease specialists conduct a series of training sessions for forest managers, consultants, and other interested landowners. In 1995 basic identification and more intensive ecosystem management sessions were held in Coeur d'Alene. Similar sessions are again planned in 1996 (for dates, locations and registration contact the appropriate IDL or USFS office).

INSECTS AFFECTING THE REPRODUCTION OF WHITEBARK PINE IN THE WESTERN UNITED STATES (Kegley/Campbell)During 1995, in cooperation with other western entomologists in Regions 4,5 and 6, we initiated a study to examine the insect complex affecting the reproduction of whitebark pine. Seven sites in the western United States were chosen with three sites in Idaho and one in Montana. The sites in Idaho are: 1) on Gisborne Mountain outside of Priest River, 2) near Seven Devils lookout tower outside of Riggins, and 3) on Snowbank Mountain outside of Cascade. The site in Montana is near Daisy Pass outside of Cooke City.

Fourteen treatments, which consisted of excluding insects with mesh bags at different times during the two-year cone development cycle, were replicated on each of 15 trees at each site. Mature cones will be collected at the end of 1996 to identify the insect complex and the damage they cause.

A preliminary study in 1994 showed that between 50-100 percent of cones collected were infested with the coneworm, Dioryctria abietivorella. During an examination of cones, flowers and pollen in 1995, we found six different insects feeding in or on reproductive structures. We have not yet determined their impact on seed production or viability.

Results of this study will help develop management strategies to reduce the impact of insects on whitebark pine.

WESTERN SPRUCE BUDWORM PERMANENT PLOTS (Campbell/Kegley) Permanent plots on the Beaverhead, Bitterroot, Deerlodge, Lewis & Clark, Lolo, Helena NFs in Montana and Nez Perce NF in Idaho were re-measured for defoliation and budworm population estimates. No new plots were established during 1995.

Light defoliation was seen on individual plots on the Helena and Beaverhead NFs. No defoliation was detected in any of the other stands.

All budworm permanent plots will be monitored annually for defoliation and damage over the long-term for budworm effects on ecosystem structure and function and for model validation.

EVALUATION OF THE FLIGHT PERIOD OF THE WESTERN BALSAM BARK BEETLE (Kegley/Gibson/Oakes/Randall). Pheromone baited Lindgren Funnel Traps® were placed in the Trout Creek drainage of the Bonners Ferry RD, IPNFs and on the Bitterroot NF in Montana, for the third year in a row to monitor the flight period of the western balsam bark beetle. Trap catches continued their downward trend in 1995. At Trout Creek, beetles were caught from June 4th through September 22nd, 1995. Peak trap catch occurred on July 3rd, but numbers remained high from 7/3/95 to 7/21/95. The summer of 1995 was more typical weather wise than either 1993 or 1994, however the total number of beetles caught continued to decline from a high of 7,287 in 1993, to 3,949 in 1994, to 794 in 1995. Because of the low number of beetles caught in 1995, we have decided not to monitor beetle flight in Trout Creek in 1996.

EVALUATION OF THE FLIGHT PATTERNS OF THE PINE ENGRAVER AND DOUGLAS-FIR BEETLE (Livingston) Information is being gathered on the flight patterns of the pine engraver and Douglas-fir beetle through the use of pheromone-baited Lindgren Funnel Traps®. Trap catch information will be correlated with temperature and precipitation data. The results of this effort will provide additional understanding of flight patterns, duration of flight, initiation of flight in relation to spring temperatures, the number of generations of beetles, behavioral activity, and the influence of weather patterns on these insects.

RED TURPENTINE BEETLE DAMAGE IN PRUNED AND THINNED WHITE PINE. (Schwandt/Kegley). Over the past four years we have surveyed over 3,500 pruned white pine in 34 different stands in seven Districts of three National Forests in north Idaho and Montana to evaluate the importance of red turpentine beetle attacks.

Our results are still being analyzed, but we have come to the conclusion that the problem is usually relatively minor. Although one stand had 41 percent of pruned trees attacked, two-thirds of the stands surveyed had less than 10 percent attacked trees and 90 percent of the stands had 1 percent or less mortality associated with this bark beetle.

We found that the red turpentine beetle will attack trees from early May through October, and pruned trees apparently remain susceptible to attack for up to two years after pruning and thinning. Trees that are stressed in some way seem to be especially susceptible to attack. Many attacks and mortality occurred in white pine growing on dry, rocky soils or on trees that had other problems such as root disease, or large basal blister rust cankers.

The red turpentine beetle also prefers larger diameter trees; only 2.3 percent of attacked trees were smaller than 1.5 inches, and the average diameter of attacked trees was 3.8 inches. A comparison of tree diameters in each stand found that the average diameter of attacked trees was larger than the average diameter of unattacked trees in 80 percent of stands and smaller in only 10 percent of the stands; (diameters were equal in the other 10 percent of stands).

In a small study of severely pruned trees (pruned to the top whorl) verses trees pruned to normal recommendations (leaving 50 percent of crown), we found red turpentine beetle attacks and damage to be much worse on the severely pruned trees. Severely pruned trees had twice as many attacks and 4.5 times the mortality of normally pruned trees. This indicates that severe pruning should be avoided, especially in trees taller than ten feet.

EFFECTS OF PRECOMMERCIAL THINNING ON ROOT DISEASE IN MIXED CONIFER STANDS (Schwandt/Oakes). The purpose of this study was to evaluate effects of root disease in young stands that had been precommercially thinned. Several stands had permanent plots established to monitor growth as part of a USFS project several years ago. Plots are remeasured every five years, and some plots had three separate measurements. Root disease information was also included with the growth information. We used this information to select stands where root disease had been recorded for an additional on-site evaluation that was conducted during the summer of 1995. A cursory review of the data indicates that mortality may not be increased significantly by precommercially thinning. However, all the data has yet to be fully analyzed statistically.

TREE NUTRITION AND ARMILLARIA ROOT DISEASE (Schwandt) The relationship between tree nutrition and resistance to root disease is the subject of a study with the Intermountain Forest Tree Nutrition Cooperative. This study was initiated near Orofino in 1989 to see if potassium or nitrogen fertilizer applications could influence concentrations of sugar/starch or phenolic compounds in trees which might result in changes in root disease. Armillaria root disease seems to prefer conditions with high sugar concentrations and is impeded by high phenolics which are considered important defense mechanisms in plants.

Four years after applying different combinations of nitrogen and potassium fertilizers to a thirty year old Douglas-fir stand with root disease, analysis of root samples found a significant reduction in root sugar concentrations accompanied by increases in root phenolic concentrations. The resulting phenolic:sugar ratios on fertilized plots were significantly higher than the controls, and the plots treated with potassium had higher ratios than those receiving nitrogen only. However, these changes have NOT had any significant effect on root disease mortality in the six years since application.

We have observed five to nine percent mortality due to root disease on nearly all treatments, and over 12 percent of the initial 358 trees have begun to show symptoms since 1989. Each year a few more trees exhibit symptoms for the first time, and for the first three years, most of these trees occurred in the controls or nitrogen only plots. However, in the past three years more and more trees with new symptoms have occurred on the plots that received a potassium treatment, which makes us wonder if potential benefits may be "wearing off". Unfortunately, the numbers are too small and variable to be statistically significant so we don't really know if these differences or trends are really meaningful.

In 1994, the Nutrition Cooperative installed another set of plots in a 30 year old Douglas-fir plantation near Hemlock Creek on the Idaho Panhandle NF to act as an additional replicate of this experiment. Initial root disease infection levels varied from 3.4 percent to 29 percent and there was some root disease mortality on seven of eight plots.

Both areas will continue to be monitored to detect any differences in root disease associated with the fertilizer applications.

TESTING THE EFFECTIVENESS OF A COMBINATION OF BARK BEETLE PHEROMONES AS ANTI-ATTRACTANTS OF THE PINE ENGRAVER (Gibson/Livingston) In 1993 and 1994, had we tested the effectiveness of ipsenol (+50/-50) and verbenone (+86/-14) in preventing attacks by pine engravers in ponderosa pine slash. While encouraging, results were not as good as had been achieved in other experiments. Research recently completed in California suggested that various combinations of attractant pheromones of a competitor species, some of which are anti-attractants of the pine engraver, might prove more effective as anti-attractants of pine engraver than its anti-attractant pheromone, alone.

In 1995, we initiated a study to investigate the properties of ipsenol, cis-verbenol, and (+)ipsdienol--the attractants of the California five-spined Ips, as anti-attractants of the pine engraver. We used combinations of these semiochemicals, and the best anti-attractant combination we had previously tested, ipsenol and verbenone in a series of Lindgren funnel traps. Our intent was to test their effectiveness in masking the aggregative pheromones of the pine engraver, (-)ipsdienol and lanierone. In addition, we tested the effectiveness of 4-allylanisole (4-aa), a host terpene, as another anti-attractant.

A single trap constituted a "treatment." There were eight different treatments in the test and each treatment was replicated five times. Identical tests were conducted in western Montana and northern Idaho:

* One trap contained the pine engraver anti-attractant (ipsenol), the mountain pine beetle anti-attractant (verbenone), and the pine engraver attractant ((-)ipsdienol and lanierone);
* another contained the attractant of the California five-spined Ips ((+)ipsdienol, ipsenol, and cis-verbenol) and the pine engraver attractant;
* a third contained two of three components of the California five-spined Ips attractant (ipsenol and cis-verbenol) and the pine engraver attractant;
* a fourth contained two of the other components of the competitor beetle (+ipsdienol and cis-verbenol) and the pine engraver attractant;
* a fifth contained the pine engraver attractant and liquid 4-aa as formulated by Dr. Jane Hayes;
* a sixth contained the pine engraver attractant, ipsenol, verbenone, and 4-aa (Hayes');
* a seventh contained the pine engraver attractant and a gelled formulation of 4-aa (Phero Tech);
* and a final trap contained only the pine engraver beetle attractant, which served as a "control."

The study was installed in early April, prior to beetle flight. It was concluded after initial beetle flight was over--near the end of June.

Though unusually cool and wet spring weather resulted in less-than-anticipated numbers of beetles trapped; in the Idaho test, we did achieve an anticipated response to the pheromone combinations. Trapping results showed only 413 beetles were caught throughout the test period in Montana. Those did not lend themselves to analysis. In Idaho, more than 1,300 beetles were trapped, nearly half in the "control" traps.

An analysis of the Idaho data showed the "control" treatment (containing only pine engraver attractant) to be significantly different from any of the other treatments. The best anti-attractant treatment effect (though not statistically different from other anti-attractants) was the combination of ipsenol and verbenone. That is the treatment with which we had obtained best results in earlier tests, and the one proven most effective in similar tests conducted elsewhere. This combination will form the basis for a follow-up test in 1996 in which we will once again attempt to prevent engraver beetle attacks in ponderosa pine slash.

EVALUATION OF INDIVIDUAL TREE CROWN SPRINKLER (Kegley). Individual, semi-permanent tree sprinkler systems were installed on 10 trees at the Coeur d'Alene western white pine seed orchard as a possible alternative to hydraulic ground spraying for protecting cones from insect damage. The tree sprinklers consist of nozzles attached to the tree terminal and connected to tubing running down the bole to ground level. The tubing is then connected to a pump on the ground when treatment is necessary, and the desired amount of pesticide sprayed at the top of the trees where most of the cones are. Coverage was good on all trees. The individual tree sprinkler treatment provided better seed protection than the regular hydraulic spray.

MOUNTAIN PINE BEETLE PERMANENT PLOTS. (Kegley/Oakes/Gibson/Randall). Permanent plots were remeasured on the Bonner's Ferry RD, IPNFs. Plots on the North Fork RD, Clearwater NF are scheduled to be remeasured in 1996. These plots will help calibrate the Cole/McGregor mountain pine beetle rate of loss model for northern Idaho as well as provide data for validation of the new western pine beetle model.

DOUGLAS-FIR TUSSOCK MOTH PERMANENT PLOTS. (Campbell/Kegley). Permanent plots on the Palouse RD, Clearwater NF were measured for defoliation and tussock moth population levels using pheromone traps. Only a few moths were caught and no defoliation noted. This is a long-term project that will help calibrate/validate the DFTM extension of the FVS model.

DWARF MISTLETOE INFECTION OF YOUNG WESTERN LARCH. (Mathiasen) This study was begun in 1991 and continued in 1995. The objective is to determine the ages at which young western larch are initially infected by larch dwarf mistletoe. Young infected larch are being sampled and their age and height when first infected determined by aging all mistletoe infections on each tree. Several temporary plots are being established around mistletoe-infected seed trees. Infection of young regeneration near the seed trees will be monitored for several years to determine infection rates in the regeneration over time.

DOUGLAS-FIR BEETLE RISK RATING. (Gibson) This was a multi-Region, two-year project initiated in 1994. Data collection was completed in 1995. Coordinated and led by Bill Schaupp (R-2) and Jose Negron (RM Station), the objective of this project is the development of a "loss prediction (risk-rating) model" for stands infested or threatened by Douglas-fir Beetle. Over the two years, we collected data from areas previously infested by Douglas-fir Beetle gathering as much site and stand data as could be reasonably measured by a two-person crew using basic stand-exam procedures. Analyses are now being performed to determine which site and/or stand factors are most correlated with Douglas-fir Beetle-caused mortality, and how those factors may help assess potential mortality during an outbreak.

During two field seasons, and covering infested areas in Colorado, Idaho, Utah, Wyoming and Montana, data has been collected on more that 700 plots. We gathered data on about 120 plots in Montana and north Idaho. Data analysis, begun in 1994 is continuing. We are hopeful that a model, helping to predict tree mortality attributable to Douglas-fir Beetle and thereby becoming a significant management tool, will be available to the land manager within the next year or two.

MONITORING OF FIELD PERFORMANCE OF BLISTER RUST-RESISTANT WESTERN WHITE PINE. (Mathiasen/Schwandt) This study is designed to monitor blister rust infection in plantations of genetically improved white pine. Permanent plots established in plantations representing different levels of rust hazard are monitored to document changes or trends in blister rust infection and pine mortality. We selected young plantations (less than seven years old) to allow monitoring of early losses, and to make it easier to distinguish planted trees from natural regeneration. In 1995, five plantations were remeasured and six additional plantations were sampled on IDL lands, primarily in the Priest Lake Supervisory Area. Infections levels for seven USFS plantations reported in 1992 (Mathiasen and Schwandt, IDL report #93-2) and changes over the past three years are shown in the following table. Five of these plantations contained second generation (F2) stock and the other two represented first generation (F1) stock. The F1 stock is expected to be about 30 percent resistant while the F2 stock is expected to be about 60 percent resistant to white pine blister rust.

TABLE 6. CHANGES IN % INFECTION LEVELS OF WHITE PINE PLANTATIONS 1992-1995

PLANTATION		RUST HAZARD	IMPROVED STOCK 1992	1995	NATURALS 1992	1995
Varnum #11	F2	high	1	1	0	1
Varnum #23-2	F2	high	3	4	20	25
Copper-Gimlet #2	F2	very high	8	8	83	83
Copper-Gimlet #21	F2	high	30	35	13	19
Copper-Gimlet #1	F2	very high	41	36	30	35
Varnum 23-1	F1	very high	51	55	21	21
Varnum #2	F1	high	66	64	53	75

Infection levels in 1992 varied from 1-47 percent for the F2 stock and were 51 and 66 percent for the two F1 plantations. Over the past three years, the amount of infection in F2 stock has remained relatively constant, while the infection levels on the natural trees have continued to rise.

We were initially concerned about the higher than expected level of infection in Copper-Gimlet #1, but the infection level has actually dropped because we had mis-identified some natural trees with infections as planted stock.

It is also surprising that the infection levels on natural trees in Copper-Gimlet #21 and Varnum 23-1 are lower than the improved stock. However, this is probably because the natural trees were half the size and age of the planted stock, so they have been exposed to infection for a shorter period of time. Mortality rates are rapidly increasing as the early blister rust infections girdle these small trees.

We expect infection and mortality levels to continue to climb in the naturally regenerated trees, while the improved stock stays at close to current levels. These plantations will continue to be monitored to provide base line information about the impact of blister rust on improved stock under different levels of hazard.

EVALUATING THE OPTIMAL DOSE OF MCH FOR PROTECTING STANDING DOUGLAS-FIR FROM ATTACK BY DOUGLAS-FIR BEETLE. (Gibson) In the second year of a two-year test, we cooperated in a field experiment to test the optimal dosage of MCH (Douglas-fir beetle anti-aggregant) for protecting standing, live Douglas-fir from attack by Douglas-fir beetle. The project was being conducted concurrently in Oregon, Idaho, Utah and Montana. We carried out the Montana portion on the Rexford RD, Kootenai NF, southwest of Eureka, MT.

MCH, in bubble-capsule formulation, was applied to stands at risk of infestation by Douglas-fir beetle, in order to test the lowest effective dose needed to protect live trees. MCH was applied at rates of 50, 100, and 150 bubble capsules per hectare in 1994. Those treatments were sufficiently effective that we tested the lower end of the scale in 1995. In 1995, we applied 15, 30, and 50 bubble capsules per hectare. Untreated plots served as controls.

We installed two "blocks" of the test, a block consisted of 4, one-hectare plots, located no closer than 200 meters to any other plot. Three additional blocks were installed in eastern Oregon, two in southern Utah, and one in southern Idaho. A "plot" was a 1-hectare, circular plot of predominantly large-diameter Douglas-fir, susceptible to Douglas-fir beetle. We chose areas close to known beetle infestations, but there could be no currently infested trees on the plot. At each plot center, we hung three Lindgren funnel traps, baited with Douglas-fir beetle pheromone attractants. On the plot's perimeter, we stapled MCH bubble capsules to standing trees. Spacing of bubble caps was determined by treatment. The four treatments were 0, 15, 30 and 50 bubble caps per plot. Treatments within the block were randomly assigned. Plots were installed in early April and monitored weekly. Treatment evaluation was conducted following beetle flight. Our evaluation was conducted in early August.

Results showed 50 bubble capsules per hectare to be an effective treatment in protecting live Douglas-fir from attack by Douglas-fir beetle. Results of the two-year test are a part of the package submitted to EPA seeking registration of MCH. When registration is finally granted, MCH should become a very effective tool in the management of stands threatened by Douglas-fir beetle.

ALTERNATIVES TO CHEMICAL SOIL FUMIGATION FOR CONTROL OF SOIL-BORNE DISEASES IN BAREROOT NURSERIES. (James) This multi-regional project was initiated in 1993 in response to the proposed banning of methyl bromide as a soil fumigant by the year 2001. Soil treatments were established in two USDA Forest Service nurseries in Idaho (Coeur d'Alene and Lucky Peak - Boise). Treatments included several organic amendments and fallowing compared to standard chemical soil fumigation. Tests concluded in the fall of 1995 on some species or in the spring of 1996 with others. Preliminary results indicate that most organic amendments stimulate populations of potentially-pathogenic organisms such as Fusarium, while fallowing with periodic cultivation may help reduce pathogen levels in soil.

Another portion of this project deals with genetic studies to ascertain pathogenic characteristics of the common soil-borne pathogen, Fusarium oxysporum. New molecular biology techniques, vegetative compatibility testing, isozyme analysis, and pathogenicity testing are being applied to define characteristics of pathogenic behavior by this important pathogen. The major goal of the work is to devise rapid techniques for differentiating pathogenic strains of the fungus in order to predict disease severity from soil populations. This work is being conducted in cooperation with the University of British Columbia and Oregon State University.

EPIDEMIOLOGY OF CYLINDROCARPON SPP. ON CONTAINER-GROWN CONIFER SEEDLINGS. (James) Investigations were continued to characterize fungal species involved in disease, assess pathogenicity, and formulate procedures to reduce losses. An evaluation to investigate fate of Cylindrocarpon spp. on outplanted white pine seedlings and their role on seedling performance continues in cooperation with the University of Idaho and Potlatch Corporation.

PATHOGENIC POTENTIAL OF FUSARIUM SPP. ON CONIFER SEEDLINGS. (James) Techniques to evaluate potential of Fusarium isolates to elicit disease on young conifer germinants are used to quickly screen isolates. Soil isolates of F. oxysporum show wide variation in virulence, whereas isolates of F. proliferatum were usually similar in their high virulence in tests. Other Fusarium isolates commonly obtained from conifer seedlings vary in their ability to cause disease symptoms on inoculated seedlings.

BIOLOGICAL CONTROL OF NURSERY ROOT DISEASES. (James) Tests to evaluate antagonistic bacteria were initiated at the USDA Forest Service Lucky Peak Nursery near Boise. Pre-sowing applications were made and effects on ponderosa pine seedling establishment, disease, and soil populations of potentially-pathogenic fungi are being monitored. The test is scheduled for completion in the fall of 1996. Another test to evaluate a potential biocontrol of Botrytis blight in container-grown western red cedar seedlings will be initiated at the USDA Forest Service Nursery in Coeur d'Alene.

EVALUATION OF THE EFFICACY OF DAZOMET (BASAMID) CHEMICAL SOIL FUMIGATION AT THE USDA FOREST SERVICE LUCKY PEAK NURSERY. (James) Fumigation was conducted in the fall of 1995 and treated fields will be sown in the spring of 1996. Effects on soil pathogen populations, seedling infection and disease, and seedling production will be monitored.

BROAD SCALE, LONG-TERM FOREST HEALTH ANALYSIS. (Byler) Insect and disease evaluations are commonly limited in scope, and address only short-term effects of these agents in limited geographic areas. They also tend to deal only with "damage" to resources, timber and to a lesser degree recreation or wildlife. Such evaluations are necessary for making decisions about treatments in timber sale areas or recreation areas, but aren't sufficient in themselves to provide a context for making broader planning decisions or developing ecosystem management policies. The Northern Region's analysis of disease and insect caused effects on forest health is an attempt to document broad scale, long-term changes in vegetation caused by insects and diseases across the region, and to quantify these changes in ways that allow prediction of future forest conditions.

Evaluation of changes in forest tree composition and structure (cover type and structural stage) is a key indicator of forest health. Major changes in the condition of western forests during the past century have been documented, and some of the changes are commonly viewed as "unhealthy" because of potential loss of long-term productivity, biodiversity risks (loss of habitat), and effects on resources. Quantifying insect and disease effects on cover type and structural stage provides a means to evaluate how these values are affected.

Information from the Clearwater National Forest is used to illustrate the approach. Forest cover type and structural stages were identified as part of an inventory made in the mid 1930's for the Clearwater and other Northern Region forests. A sample of forest sub-compartments was inventoried in the mid 1970's. A Geographic Information System analysis of the change in stand cover type and structural stage during that 40 year time period provides information on kinds and rates of transitions to different types and stages. Rating of stands for insects and pathogens capable of causing successional transitions allows us to identify probable cause of change. Results of this analysis show a major loss of the potentially long-lived seral species of western white pine, western larch and ponderosa pine during the forty years (Figure 1). The area that had been recently burned, or was in shrub cover type also decreased. The remainder of the forest types gained in acreage.

Six percent of the sample area was classified as white pine seedlings or saplings in the 1930's. By the 1970's none of the area contained sufficient white pine (15 %) to qualify as white pine cover type (Figure 2). We attribute this mainly to the effects of white pine blister rust, that was beginning to significantly affect northern Idaho forests by the 1940's. Small trees are very vulnerable to the rust, and only a very small percentage of the trees were resistant. Thus seedling and sapling stands of non-resistant white pine are given a high rating for the probability of type change caused by the rust. The removal of white pines from the stands caused a transition to another cover type, most commonly Douglas-fir and lodgepole pine.

Nine percent of the area was classified as white pine pole stands, and only one fourth of this area was classified as white pine by the 1970's (Figure 3). This result supports our hypothesis that blister rust would also cause a transition of pole stands, but at a slower rate because of the longer time needed to kill larger trees. Many stands were converted to Douglas-fir and lodgepole pine, but many also went to cedar and/or grand fir.

Transitions were similar, but less complete in stands that were classified as mature white pine, i.e. a loss of white pine types and a gain in climax cover types cedar/grand fir and subalpine fir (figure 4). We attribute the loss of white pine type to the combined effects of mountain pine beetle, the rust, and harvesting. Only a small percentage was converted to Douglas-fir or lodgepole pine, as these species had largely dropped out of the stands by this stage.

Two percent of the area was in Douglas-fir poles in the 30's, and only 12 percent remained by the 70's (figure 5). The transition was mainly to cedar and/or grand fir types. Changes in structural stage also occurred. Many of the cedar/grand fir stands were 2-storied rather than single storied stands. Twelve percent remained Douglas-fir poles. Our hypothesis that these transitions are mainly caused by root diseases and associated bark beetles is supported by high root disease ratings for stands of Douglas-fir in this size class. Douglas-fir is most susceptible to mortality from root pathogens, and the effects on stand composition and structure becomes pronounced between 40 and 80 years of stand age, approximately what is seen here. The results match what is observed in the field: root diseases cause transitions to climax forests of cedar and or grand fir by preferentially killing Douglas-fir; grand fir stands are also affected by root diseases but to a lesser degree, and root disease mortality causes a multi-storied condition.

Half of the area classified as lodgepole pine poles in the 30's had changed to another type (figure 6), mainly to cedar/grand fir or to Douglas-fir. We hypothesize that mountain pine beetle was a significant cause of the change, since it becomes an active killer of lodgepole pine at about 80- years of stand age and eight inches of tree diameter on cedar and grand fir habitat types. But other insects, pathogens, and "natural" succession in the absence of fire may also have contributed.

Transitions of subalpine fir pole stands also appear reasonable (figure 7). About a third remained pole subalpine fir stands, a third changed to subalpine fir mature single-storied stands, and a third to mature multi-storied stands. Subalpine fir is a climax species, and tends to be short lived in part due to the effects of root diseases and western balsam bark beetle. Our analysis suggests that these agents prevent transition to mature stands or cause a multi-storied condition in stands that do reach maturity.

Twenty nine percent of the area was classified as recent burns, and by the 70's most of the area had changed to one of the forest types (Figure 8). We hypothesize that in the absence of blister rust, a third or more would have become white pine type, but only 2 percent made this transition. The largest gains were to lodgepole pine and climax forests of subalpine fir, cedar and grand fir.

Figure 9 is a synthesis of the 40 year changes. The area occupied by potentially long lived seral tree species was reduced by about half. The loss of white pine is attributed to the combined effects of blister rust, mountain pine beetle and harvesting. The reduction in other species is likely due to pine bark beetles, fire suppression and harvesting. The proportion of Douglas-fir and lodgepole pine doubled. These are short-lived seral species on most of these sites in-part because of root diseases and bark beetles (Douglas-fir), and mountain pine beetle and other agents such as dwarf mistletoe (Lodgepole pine). There was a several fold increase in climax forests of cedar, grand fir and subalpine fir. We consider this to be the net effect of insects and pathogens on succession in the absence of stand replacement fires or regeneration harvesting.

Analyses in progress will provide more detailed information on long-term changes across northern Idaho and western Montana forests, and information on rates of disease and insect caused changes to calibrate succession models which are used to predict future conditions under different management regimes. In the meantime, some general conclusions can be drawn from these early results. 1) The introduced white pine blister rust caused a dramatic reduction in white pine type during the 40 year study period, a trend that has continued until today in wild stands. Very little of that cover type remains, and more importantly the disease continues to prevent its replacement. 2) Results support our hypotheses regarding the roles of insects and pathogens in succession. The dynamic nature of northern Idaho forests is due in part to the rapid rates of change caused by root diseases, bark beetles and other agents. They accelerate or retard succession to climax cover types and different structural stages by preferentially killing certain tree species at particular age classes. 3) The net effect of the introduction of white pine blister rust, selective harvesting, fire suppression, and other human activities have altered succession in a major way. In the past, native diseases, insects, mixed severity fires, and other factors removed climax and short-lived seral species from mixed species stands that originated after stand replacement fires. The outcome was the creation and maintenance of forests of long-lived seral white pine, western larch and ponderosa pine cover types. Since European settlement, these long-lived serals have been removed by harvesting and blister rust as well as the activities of native agents such as bark beetles. In the absence of wildfire or regeneration treatments, the outcome is an acceleration to climax forests on a large scale, as documented here.

Figure 1. Percent Cover Type Change in Forty Years on the Clearwater National Forest.

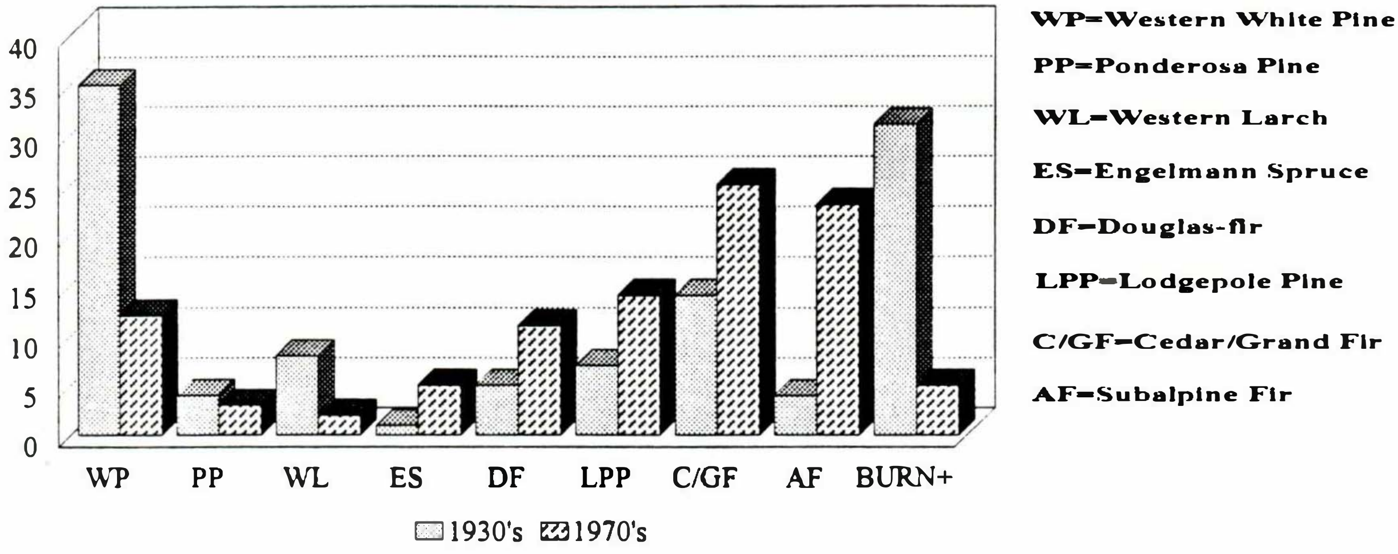


Figure 2. Percent Cover Type Change in Forty Years for Western White Pine Seedling/Sapling Stand (6% of the area)

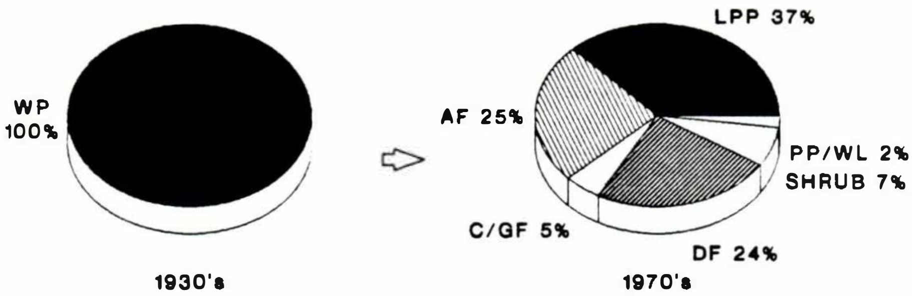


Figure 3. Percent Cover Type Change in Forty Years for Western White Pine Pole Stands (9% of the area).

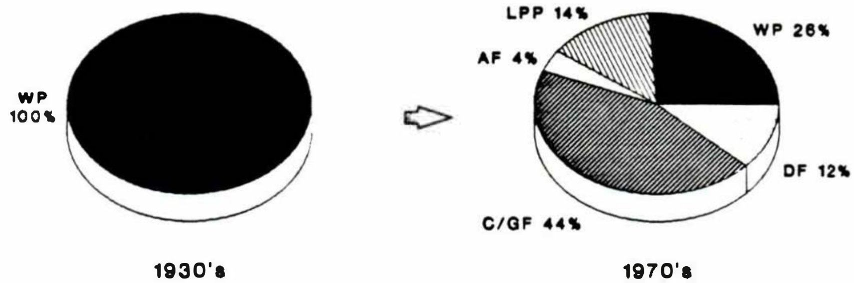


Figure 4. Percent Cover Type Change in Forty Years for Western White Pine Mature Stands (18% of the area).

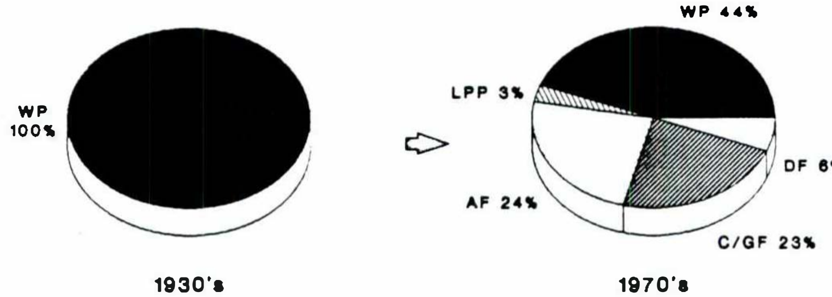


Figure 5. Percent Cover Type & Structural Stage Change in Forty Years for Douglas-fir Pole Stands (2% of the area).

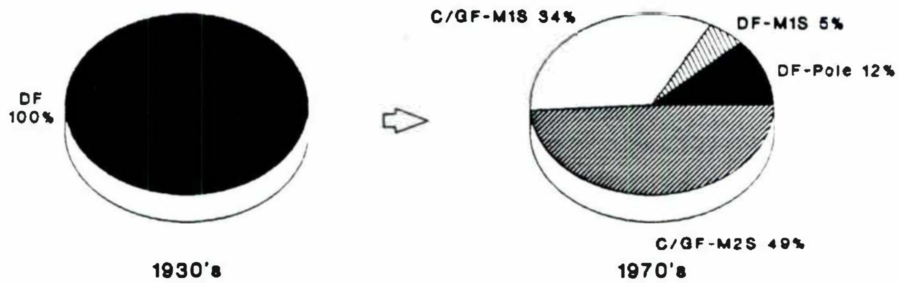


Figure 6. Percent Cover Type Change in Forty Years for Lodgepole Pine Pole Stands (3% of the area).

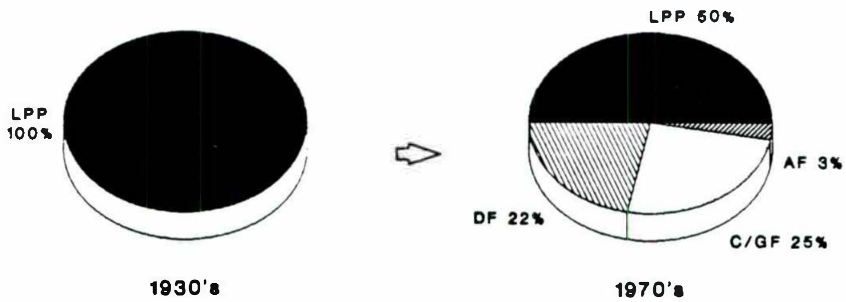


Figure 7. Percent Cover Type & Structural Stage Change in Forty Years for Subalpine Fir Pole Stands (2% of the area).

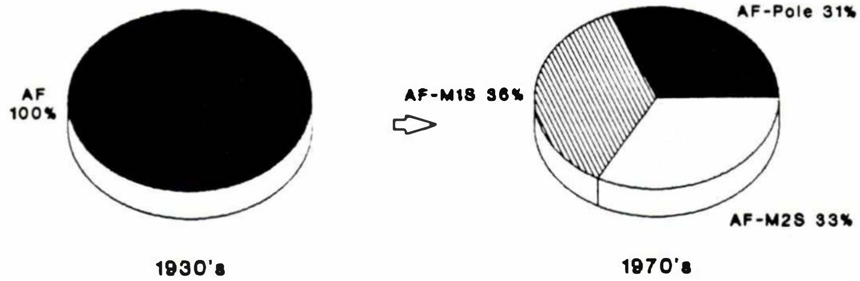


Figure 8. Percent Cover Type Change in Forty Years of Recent Burns (29% of the area).

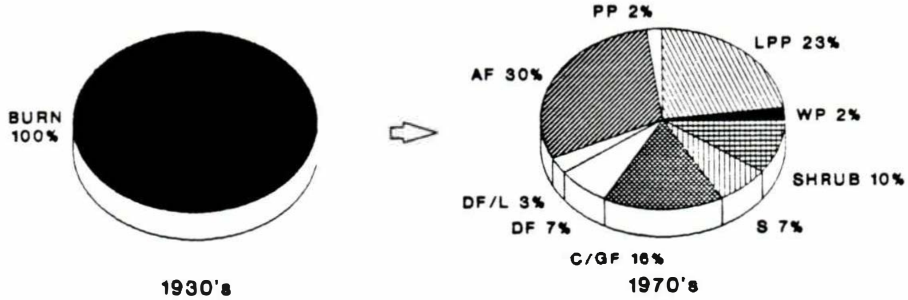
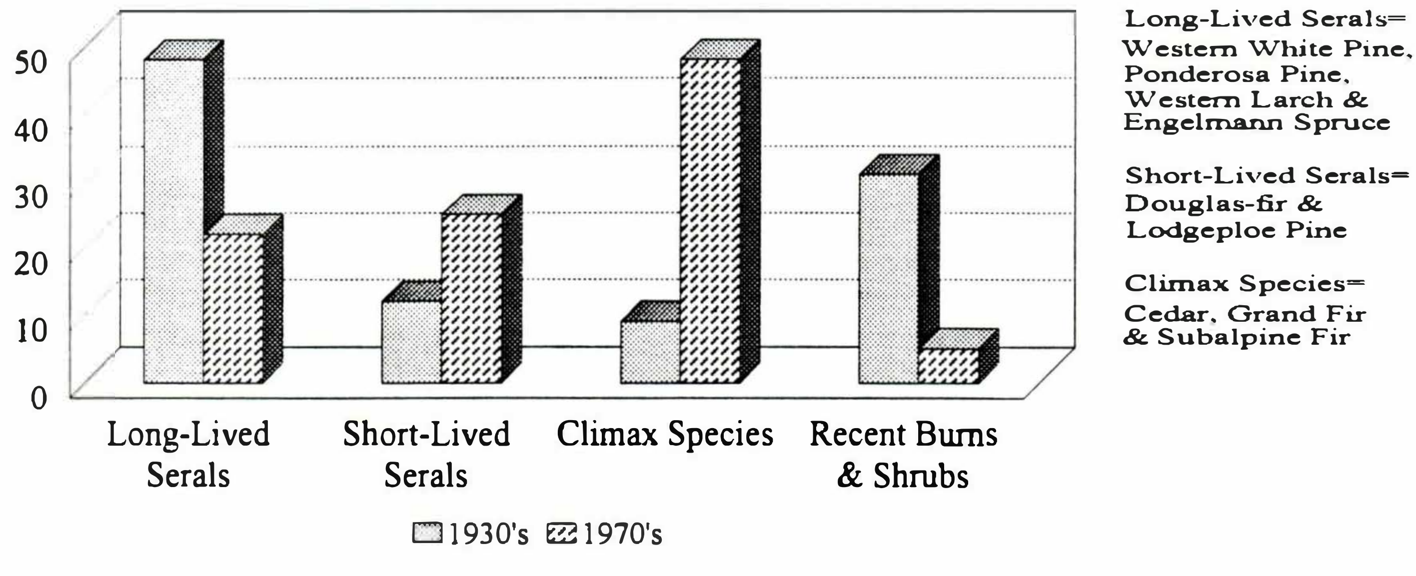


Figure 9. Percent Cover Type Change in Forty Years on the Clearwater National Forest.



COMMON AND SCIENTIFIC NAMES OF INSECTS

Balsam woolly adelgid	*Adelges picea* (Ratzburg)
Black-headed budworm	*Acleris gloverana*
Boxelder leafroller	*Caloptilia negundella* (Chambers)
California five-spined Ips	*Ips paraconfusus* Lanier
Cone feeding adelgid	*Pineus coloradensis* (Gillette)
Cone moth	*Eucosma recissoriana* Heinrich
Cone worms	*Dioryctria* spp.
Cranberry girdler moth	*Chrysoteuchia topiaria* (Zeller)
Douglas-fir beetle	*Dendroctonus pseudotsugae* Hopk.
Douglas-fir tussock moth	*Orgyia pseudotsugata* McDunnough
Fir engraver	*Scolytus ventralis* LeConte
Gypsy moth	*Lymantria dispar* (L.)
Lodgepole terminal weevil	*Pissodes terminalis* Hopping
Lodgepole needleminer	*Coleotechnites milleri* Busck
Mountain pine beetle	*Dendroctonus ponderosae* Hopk.
Pine engraver	*Ips pini* (Say)
Pine needle sheath miner	*Zelleria haimbachi* Busck
Red turpentine beetle	*Dendroctonous valens* Le Conte
Rusty tussock moth	*Orgyia antiqua* (L.)
Spruce beetle	*Dendroctonus rufipennis* (Kirby)
Tip moth	*Rhyacionia zozara* (Kearfott)
Western balsam bark beetle	*Dryocoetes confusus* Swaine
Western conifer seedbug	*Leptoglossus occidentalis* Heidmann
Western pine beetle	*Dendroctonus brevicomis* LeConte
Western pine shootborer	*Eucosma sonomana* Kearfott
Western spruce budworm	*Choristoneura occidentalis* Freeman

COMMON AND SCIENTIFIC NAMES OF DISEASES

Annosus root disease	*Heterobasidion annosum* (Fr.) Bref.
Armillaria root disease	*Armillaria ostoyae* (Romagn.) Herink
Atropellis canker	*Atropellis piniphila* (Weir) L. & H.
Black stain root disease	*Leptographium wagneri* (Kendr.) Wingf.
Brown cubical butt rot	*Phaeolus schweinitzii* (Fr.) Pat.
Comandra blister rust	*Cronartium comandrae* Pk.
Conifer-Aspen rust	*Melampsora medusae* Thum.
Conifer-cottonwood rust	*Melampsora occidentalis* Jacks.
Cylindrocarpon root disease	*Cylindrocarpon* spp.
Cytospora canker of firs	*Cytospora abietis* Sacc.
Diplodia tip blight	*Sphaeropsis sapinea* (Fr.) Dyko
Dutch elm disease	*Ceratocystis ulmi* (Buism.) C. Mor.
Dwarf mistletoes	*Arceuthobium* spp.
Elytroderma needlecast	*Elytroderma deformans* (Weir) Dark.
Fir broom rust	*Melampsorella caryophyllacearum* Schroet.
Fir needlecast	*Lirula abietis-concoloris* (Mayr:Dearn) Darker
Fir needle rust	*Pucciniastrum epilobii* Otth
Fusarium root disease	*Fusarium* spp.
Grey mold	*Botrytis cinerea* Pers. ex Fr.
Indian paint fungus	*Echinodontium tinctorium* (Ell.& Ev.) Ell. & Ev.
Laminated root rot	*Phellinus weirii* (Murr.) Gilb.
Larch needle blight	*Hypodermella laricis* Tub.
Larch needlecast	*Meria laricis* Vuill.
Lodgepole pine needlecast	*Lophodermella concolor* (Dearn.) Dark.
Marssonina blight	*Marssonina populi* (Lib.) Magn.
Phoma blight	*Phoma* spp.
Pine needle rust	*Coleosporium sp.*
Pythium root disease	*Pythium ultimum* Trow.
Red ring rot	*Phellinus pini* Pilat.

Rhabdocline needle cast	*Rhabdocline pseudotsugae* Syd. *Rhabdocline weirii* Parker & Reid
Schweinitzii root/butt rot	*Phaeolus schweinitzii* (Fr.) Pat.
Shepard's crook	*Venturia macularis* (Fr.) E.Muller & Von Arx
Sirococcus tip blight	*Sirococcus strobilinus* Preuss.
Stalactiform rust	*Cronartium coleosporioides* (Diet. & Holw.) Arth.
Spruce broom rust	*Chrysomyxa arctostaphyli* Diet.
Spruce mottled needlecast	*Rhizosphaeria kalkhoffii* Bud.
Swiss needle cast	*Phaeocryptopus gaeumannii* (Rhode) Pet.
Tomentosus root disease	*Inonotus tomentosus* (Fr.) Gilb.
Western gall rust	*Endocronartium harknessii* (Moore) Hir.
White pine blister rust	*Cronartium ribicola* Fisch.
White pine needlecast	*Lophodermella arcuata* (Darker) Darker

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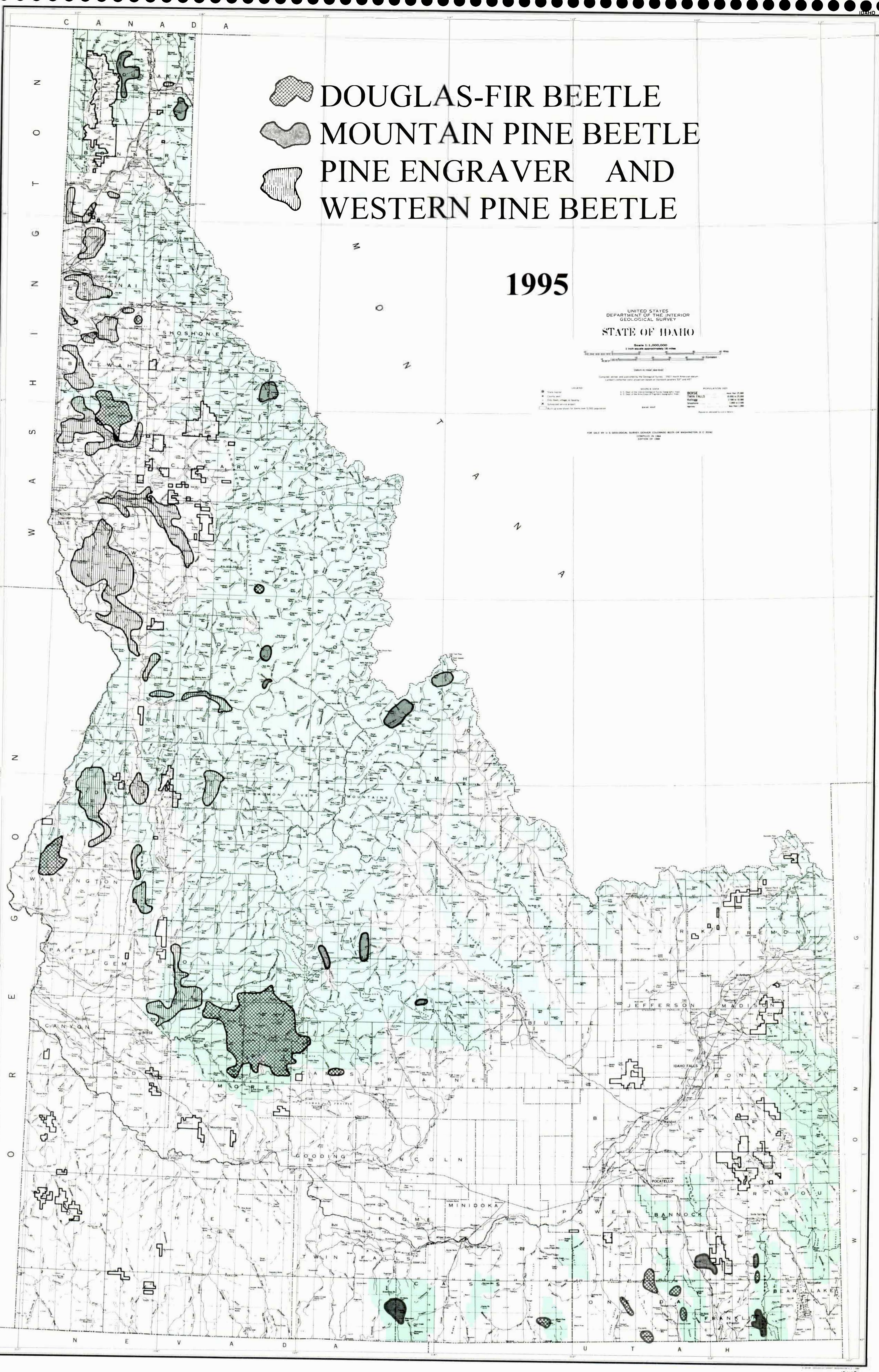

IDAHO
DOUGLAS-FIR BEETLE
MOUNTAIN PINE BEETLE
PINE ENGRAVER AND
WESTERN PINE BEETLE
1995
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
STATE OF IDAHO
CANADA
WASHINGTON
OREGON
MONTANA
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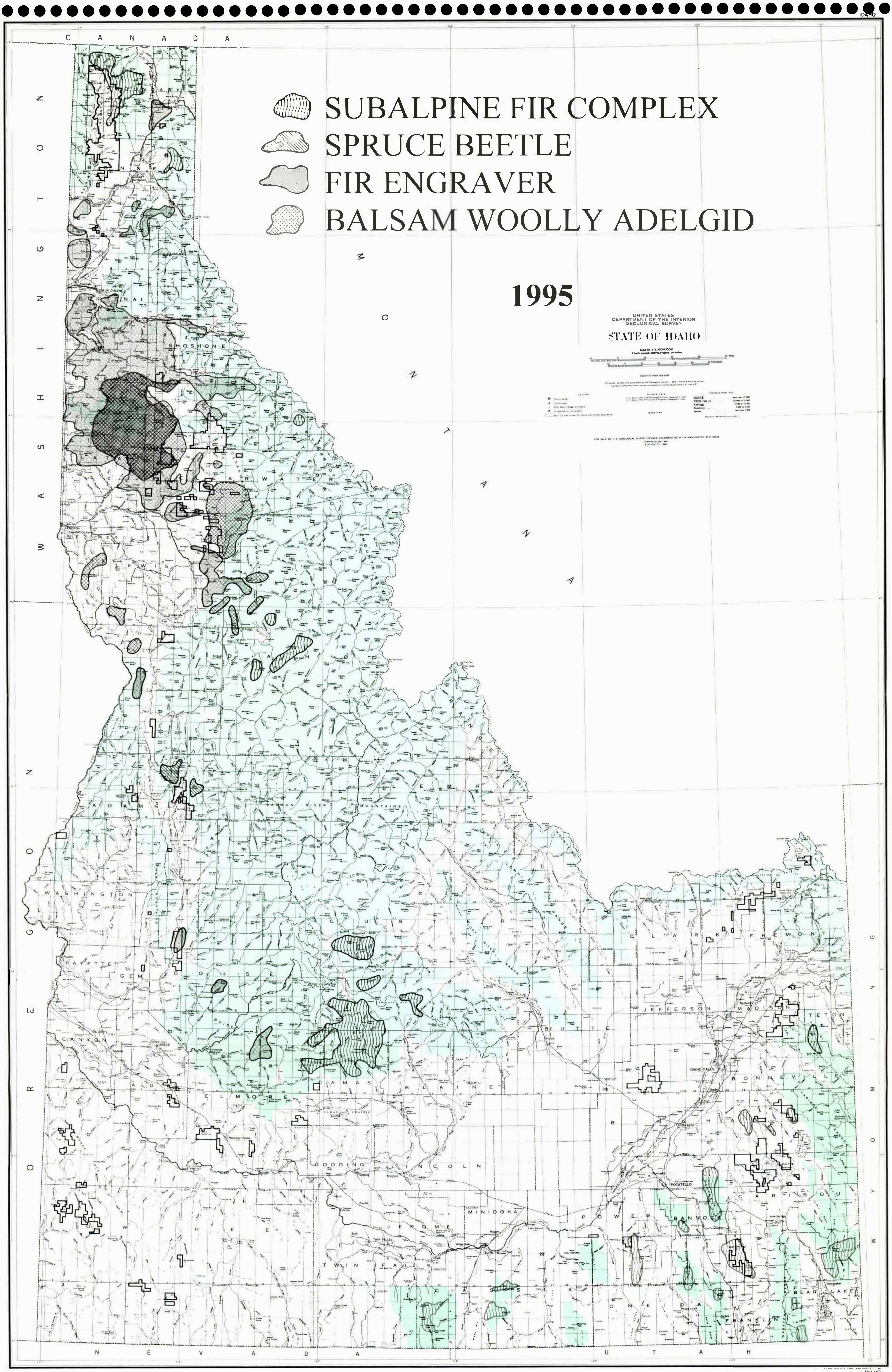
UTAH
IDAHO


SUBALPINE FIR COMPLEX
SPRUCE BEETLE
FIR ENGRAVER
BALSAM WOOLLY ADELGID
1995
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
STATE OF IDAHO
C A N A D A
W A S H I N G T O N
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